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Marine Engineer

And Naval Architect.

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Edited by Reginald Wm. James, A.M.I.C.E., M.I.M.E., Etc.

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The Marine Engineer
And Naval Architect.
LONDON, AUGUST, 1909.

THE FLEET AND THE CITY

THE interesting functions of last month, in which the British Navy and the City of London joined forces, form important features, not only in the history of our first line of defence, but also in the traditions of the most important and most influential capital in the world. It was indeed a happy inspiration that the present genial and high-minded Lord Mayor of London should invite the fleet to the Thames, not only from the point of view of interchanging courtesies and extending hospitality, but also to give the inhabitants of the metropolis an opportunity of gaining some idea of what the British Navy is. It is very difficult for the ordinary man in the street to understand from second-hand knowledge how everything is now-a-days worked by mechanical power of the most up-to-date character, and therefore personal acquaintance with the fleet will clear away much of the mist that must have necessarily clouded his intelligence in the past. The progress of science is such that ships become out of date in a few years—in fact, in twenty years they become obsolete—and Admiral Sir William May was quite right, in his response to the toast of "The Fleet" at the luncheon at the Guildhall, when he said that the maintenance of such a navy as Great Britain required the possession of great wealth, and that the wealth of the Empire lies in the heart of the City of London. Therefore while, on the one hand, the City was necessary for the maintenance of the navy, on the other hand the Navy was necessary for protecting the City which controls the wealth of the Empire. It would seem that while the citizens are likely to benefit by the visit of the fleet, there will also be a deep and lasting impression made upon the officers and men by the hearty and generous reception given to the 1,200 men and the 500 officers who were treated with the usual civic hospitality within the walls of our ancient Guildhall. It is impossible to adequately define the feelings of those officers and men who, sitting beneath the shadow of the Monument erected by the Corporation of London in grateful remembrance of the signal services rendered to his country by the immortal Nelson, listened to the stirring speeches, full of sentiment, of duty and of appreciation. What were the impressions conveyed by these men to their comrades on their return to their ships? We venture to think that the effects of these gatherings will have a most important bearing on the *personnel* of the navy, not only as regards the bond of friendship constantly shown by the City, but also as to the preparation and training to the highest degree of efficiency, so that, as the Admiral said, the Navy may be able always truly to say, "Ready, aye ready." We venture to think that the Lord Mayor is deserving of the sincerest gratitude of the nation for his thoughtful and beneficial action, and has well earned the honour of his name being handed down to posterity in the traditions of the Navy and the City alike as that of the first Lord Mayor officially to invite and entertain the fleet.

ADJUSTMENT OF ENGINEERS' WAGES: CHARACTER NOTES.

WE note that the local branch of the Amalgamated Society of Engineers has been agitating in the direction of settling that the hours and wages appertaining to the members of the Society employed on the North-East Coast and other marine districts shall be the same in all cases. We gather that the engineers on the Clyde work for 54 hours per week for 1½d. less wages than are paid to members on the North-East Coast who work only 53 hours, and if the result of the agitation is to correct this inequality, it does not seem to us that the matter can rest here, as it will follow that all the other classes of workmen will be interested in arriving at similar uniformity in the areas defined in the settlement. This does not affect the men only, but also the masters, as it is clear that for proper organization in large works it would be impossible to allow a different period of service for one class of workmen compared with any other class of workmen. It will, therefore, be recognised that dealing with the matter in this fractional way is not likely to lead to any permanent result, for the reason that, while the men may adjust wages on the up-grade and hours on the down-grade, the federated employers in the district will feel that if this is done, a broad question of employment will have to be dealt with on a National basis, and those local conditions which have in the past governed the local settlement of such matters in each case will have to be wiped away. We hope that the general good feeling which appears to exist between the masters and men in the Clyde district will enable the matter to be dealt with upon a practical basis.

As evidence of the good feeling we would refer to the discarding by the masters of the system of private enquiries and the substitution therefor of an open system of discharging notes. It has been found in the past that an employee who had been actively engaged in agitation has found great difficulty in obtaining permanent employment because his recorded career as an agitator followed him wherever he went and resulted in his having great difficulty in obtaining continuous employment. Under the new system each man on discharge will receive a note bearing all the particulars necessary for another employer to have to decide whether he

will employ him or not, and in this way the workman will be in the same position as a sailor when he signs off after a voyage. This is not a new experiment by any means, as the merits of the system have already been proved in the shipyards on the Clyde and we have no doubt, now the system has been extended to the engineers, that the relationship between them and their masters will be materially improved and the status of the workmen be raised. We would express a hope that this system, which only applies at the moment to the Clyde district, may be extended through the action of the Federated Association to other districts, so that uniformity of procedure will obtain over a wide area. It is a matter of congratulation that two important matters such as we have been dealing with above, are being dealt with in such a practical manner by both men and masters, and we hope that when serious difficulties are pointed out by either side, such difficulties shall be given their proper proportion and their settlement be based upon an equitable foundation.

Examination of Engineers.—The Board of Trade (Marine Department) has issued the following instructions to examiners and notice to candidates:—On and after January 1st, 1910, the last clause of paragraph 23 (a) of the regulations relating to the examination of engineers in the mercantile marine will be cancelled, and the following clauses will be substituted therefor:—If the candidate has served as an apprentice engineer or as journeyman, under the conditions above prescribed, for less than four years, he will be required to make up the deficiency or to complete this period of four years by service as engineer at sea on regular watch on the main engines or boilers (1) of a foreign-going steamer of not less than 66 nominal horse power, or (2) of a home-trade steamer of not less than 66 nominal horse power, such service to be counted as equivalent in the case of (1) to two-thirds, and in the case of (2) to four-ninths, of service as apprentice engineer or as journeyman. If the candidate has not served at all as apprentice engineer or as journeyman, he will be required to have served at sea, in lieu thereof, as engineer on regular watch on the main engines or boilers, six years in a foreign-going steamer of not less than 66 nominal horse power, or nine years in a home-trade steamer of not less than 66 nominal horse power.

N.B.O. Sheet Jointing.—The N.B.O. sheet jointing is manufactured by the Home Rubber Company, of Balfour House, Finsbury Pavement, London, E.C. This material is a black sheet which will withstand the action of steam, acid oil and alkaline. It is claimed that the jointing has a high tensile strength, and retains its elasticity, even after long use under high steam pressure; while not undergoing any hardening effect from heat. It is equally applicable for air and water joints, while with joints subjected to vibration it is particularly successful in obtaining thorough tightness. As the title implies, this jointing never burns out, and never blows out.

Steam Tug and Tender "Sara Thomson."—This interesting little vessel has been delivered to the owners, Messrs. Eastmans, Ltd., by Messrs. James Pollock, Sons & Co., Ltd., the tug experts of 3, Lloyd's Avenue, E.C., who designed and constructed her for attending upon the vessels of the home and other fleets in the neighbourhood of Chatham, Sheerness, etc. The dimensions of the *Sara Thomson* are—Length, 40 ft., with a beam of 8 ft. 8 in., the machinery consists of a set of compound surface condensing engines and a return tube boiler and auxiliary engines. On trial this vessel obtained the satisfactory speed of nine miles per hour under adverse conditions. The teak deck-house forward will be useful for many purposes.

ITALIAN BATTLESHIP "NAPOLI."

In every comparison of warship design it is usually very difficult to correctly estimate the exact standing of Italian vessels. With the possible exception of Russia, no other nation has introduced so many novelties into the museum of naval architecture as has Italy, and no other nation has so correctly estimated her naval requirements of seven years or so afterwards and drawn up her designs accordingly. Her small programmes can allow for no gradual evolution of type such as we can afford in our own navy, but her designers are compelled to take time by the forelock and by intelligent anticipation produce a ship which, after allowing for the delays and slow construction that have hitherto so unfortunately hampered their organization, will when completed fill a rôle in naval warfare that only Italy had foreseen.

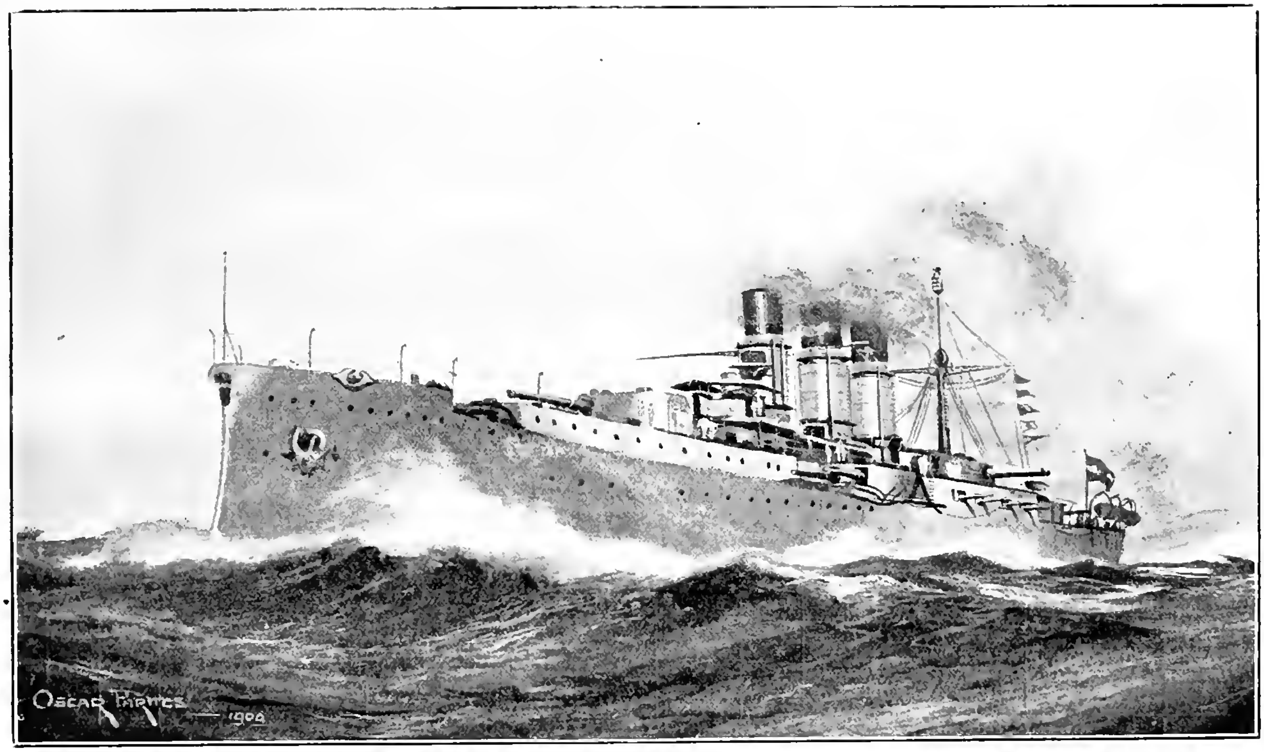
The "Napoli" class of four ships is a striking instance of this. When first projected in 1900-1 the design was received with more than scepticism, and the general consensus of opinion was that the ships would be too light for their armament and speed—that such a seemingly miraculous combination of qualities as was exhibited could not be crowded into such a moderate displacement. Their classification was fixed as "second-class battleships," although at the same time it was dimly perceived that *if* their speed was realized no battleship then afloat or building could catch them and few cruisers outsteam them, let alone stand the slightest chance in an action against them.

Now that the four ships are completed, let us review the changes that have taken place in the general scheme of naval warfare, and see to what extent the *Napoli* will serve Italy's wants after the lapse of nine years between their inception and completion.

In the first place, wireless telegraphy has to a great extent eliminated the necessity for the bigger "scouting" cruisers—"Diadems," "Jeanne d'Arcs" and the like—and relegated this duty to the smaller "Forwards" and ocean-going "destroyer" types. Again, the growth of primary batteries on battleships, the gradual addition of 8", 9·2" and 10" guns as intermediaries between the 12" and 6", and, finally, the evolution of the all-big-gun type have rendered the battleships we designed in 1900 (the "Queen" class) semi-obsolete, while the all-round growth of speed has removed the only advantage the "armoured cruisers" proper ever possessed over the battleship. Hence, briefly, we find modern warships have dwindled from three classes of battleship, two of armed cruiser, three or more of protected cruiser, torpedo gunboats, etc., down to one type of standard "all-big-gun" battleship, "all-big-gun" battleship-cruiser, "scouts" and big destroyers. Now, how does the *Napoli* stand in this new era after her years of incubation? Why, simply that on all sides she and her sisters are acknowledged to be "ideal" armoured cruisers, amply filling every rôle that can at the present time be allotted to them.

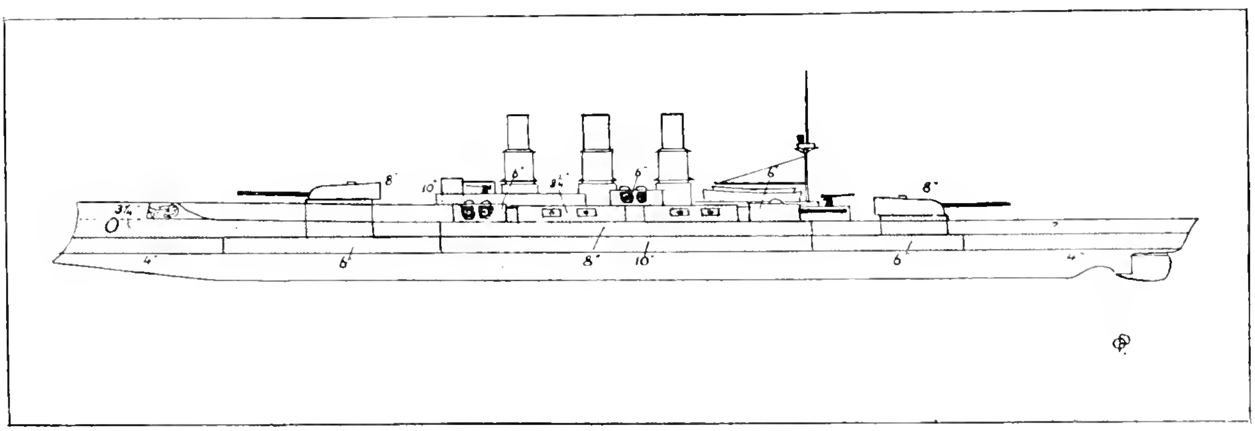
Their speed is sufficient to enable them to pick and choose their opponents and accept or refuse an action, their armament is heavy enough to fight most battleships and—bar "Invincibles"—any armoured cruisers, while their protection and coal supply leaves little to be desired. In fact, taking into consideration the

smallness of Italian naval expenditure—which postulates small ships when built in squadron—one cannot help but see that these contain the quintessence of all the qualities that go to make the ideal warship, and



The *Napoli*.

are suited to Italy's needs infinitely better than would be some normal development of her previous battleship class—the "Benedetto Brin's." Concurrently with the "Napoli" class Italy has constructed the four "Amalfis," which are very heavily armed "armoured cruisers," but lacking the 12" guns of the



Napoli and her protection. Exactly what war use these vessels will have that could not be equally well performed by the bigger ships is not at present quite clear. However we shall be dealing with them in a subsequent issue.

In order to fully appreciate the marvellous ingenuity of Colonel Cuniberti—the "father" of the "Dreadnought" conception—we append at the end of the article a comparative table of the best ships of, or about, the displacement of the *Napoli*, from which it may be seen what a variety of types have been designed on 12,000-13,000 tons, and, owing to the fact that some are battleships and others cruisers, the good all-round qualities of the *Napoli* may be sized up. Our *Achilles* she could blow out of the water, the *J. Ferry* would never stand the slightest chance in an action with her, while the three battleships could be either fought or left, according to the size of the respective squadrons; individually the *Napoli* would suffer by reason of her lack of big guns. For the

present they will not have to fight "Dreadnoughts" in the Mediterranean (while no Austrian ships yet completed are a match for them by a long way), but by the time "all-big-gun" ships predominate in the world's navies so surely by then will Italy have a type ready better than anything afloat that could be a possible antagonist.

Col. Cuniberti has been able to create such ships as the *Napoli* and *Amalfi* by drastically cutting down superfluous weight in every way. Scantlings are light, but not dangerously so; all the usual wood fitments have been replaced by asbestos, and metal fixings are hollow. Everywhere a pound has been saved here, and a pound there, so that in all something like 2,000 tons of dead weight have been dispensed with. As may be seen from our illustration, the *Napoli* suffers from no superfluity of top-hamper. Her funnels have had continuations fitted recently to improve and regulate the natural draught, so that they are now some 15 feet higher than formerly, but otherwise she offers a marvellously small target.

The big guns are in single barbettes fore and aft. If by the addition of a moderate amount to the displacement these could have been paired, the ship would have been improved immensely and "in Squadron" superior to our "King Edwards," but this modification would have necessitated such drastic increase of dimensions that the ideal aimed at could not have been attained for the money voted. As it is the ships just accomplish what was intended, and from recent accounts are quite satisfactory sea-boats. Weight was saved to the last pound, but with it all the structural stability was in no way sacrificed, as without sea-going qualities the advantages otherwise gained would have been annulled.

The twin 8" gun turrets are so mounted that eight guns can be fired ahead or astern and six on each beam. There is very little blast experienced forward when the amidship guns fire axially. The alternate disposition of the *Tsarevitch* raising the wing and lowering the centre turrets so that these latter would be on the present level of the wing ones and *vice-versa* meant the addition of too much top weight.

The 3" guns are well disposed and can bring a good all-round fire to bear on torpedo attack. As we have previously remarked in these articles, the 3" gun is now rather light for this work, but it must be remembered that the recent great increases in size of destroyers could hardly have been anticipated in 1900, when even the 3-pounder gun was considered quite heavy enough for such work.

Power.	Vessel	Displacements in Tons.	Dimensions.	Designed I.H.P.	Designed Speed. Trial Maximum.	Belt.	Deck.	Big Gun Protection.	Secondary Protection.	Armament.	Torpedo Tubes.	Laid down.	Completed.	No. in Class.
Italy	*Napoli* B.C.	12,425	475' × 73½' × 26'	20,000	21—23	10"—4"	3¼"	8"—6"	6"	2 12", 12 8", 12 3", 12 3-pounders	4	'01–'03	'07–'08	4
England	*Achilles* C	13,550	480' × 73½' × 27½'	23,580	23—23	6"—4"	¾"	7"—6"	6"	6 9 2", 4 7 5", 25 3-pounders.	3	-'04	'07	4
France	*Jules Ferry* C	12,410	486' × 70¼' × 27'	27,500	22—23	6¾"—3"	2¼"	8"	5½"—4"	4 7 6", 16 6 4", 24 3-pounders	5	'01–03	'03–'06	3
U.S.A.	*Mississippi* B.	13,000	382' × 77' × 25'	10,000	17—18 4	9"—4"	3"	12"—8"	7"—6"	4 12", 8 8", 8 7", 20 3"	2	'04	'07	2
Germany	*Hannover* B	13,200	430' × 72' × 26'	16,000	18—19 2	9¾"—4"	3"	11"	6¾"	4 11", 14 6 7", 20 24-pounders.	6	'03–'05	-'06–'08	5
Russia	*Ievstafi* B	12,800	366' × 74' × 28'	10,600	18—?	9"—2"	2¼"	12"	5"	4 12", 4 8", 12 6", 14 3"	4	'03	'09	2

B.C. Battleship Cruiser. *B.* Battleship. *C.* Cruiser. Comparative Table see *Napoli*.

INSTITUTE OF MARINE ENGINEERS.

A Visit to Messrs. Doulton & Co., Ltd.

ON Saturday, July 10th, a visit was paid by the members of the Institute of Marine Engineers to the premises of Messrs. Doulton & Co., Limited, Lambeth.

The name of Messrs. Doulton is universally associated with the manufacture of decorative pottery, but it is also known in commercial circles as one of the most eminent firms of sanitary engineers in the country. Established at Lambeth in the year 1815, in Vauxhall Walk, a move was made in 1820 to High Street, Lambeth, at which time the small pottery of Messrs. Doulton & Watts worked but one kiln per week, the staff consisting of about twelve persons. The business steadily increased until the factories and studios at Lambeth now cover some seven or eight acres of ground, while the output of stoneware pipes alone, made at the various works of Messrs. Doulton in London, Staffordshire and Lancashire, amounts to about thirty miles of pipes weekly.

The marine sanitary fittings first claimed the attention of the visitors, and interest was shown in a new type of heater for supplying hot water to baths. This is intended to be used with exhaust steam and is capable of delivering ten gallons of water per minute, raised 50 deg. in passing through the heater. Another feature was Messrs. Doulton's patent mixing valve, so constructed that either hot, cold or tepid water can be obtained with one turn of the lever, and arranged so that the cold water must always be turned on first, thus avoiding the risk of scalding. There was also shown a new type of valve which will commend itself to those who have to provide for the supply of drinking water on board ship around coasts where the supply of water for drinking purposes has to be economized. The valve is made so that only a given quantity of water can be delivered, and it is impossible to tie the handle up, or in any other way to tamper with the valve, in order to get a greater supply than the valve is regulated to give.

Specimens of the pump, single and double valve, and underline closets, baths and fittings, lavatory and sanitary fittings of all kinds recently supplied by Messrs. Doulton to some of the leading steamship companies were shown, and it may be remarked that the firm supplied the whole of the sanitary fittings to the Cunard Co.'s *Mauretania*. A demonstration was then given of the method of making a metallo

keramic joint—a process for soldering a lead soil pipe to the pottery outlet. The outlet is coated with metal during the process of manufacture and the lead pipe is then soldered to this in the usual way. A very efficient joint is produced which is capable of standing pressure of 35 ft. head.

After a visit to the brass-finishing and other workshops the visitors were conducted to the art show-room, where some of the beautiful productions which have distinguished Messrs. Doulton in the world of ceramic art, were viewed and admired. It was pointed out that the Lambeth Pottery is, in the main, a stoneware pottery, the processes, especially those relating to the firing, being greatly different from those in use in other potteries. The heat to which the stoneware kilns are fired is very intense, and the pieces only receive one firing, lasting several days, only the most carefully prepared clays emerging perfect from the ordeal. The process of salt-glazing, used in this pottery, is not applicable to any other kind of ware than stoneware, as the glaze is really formed by the partial fusion of the clay itself. During the last stage of firing, when the ware is just on the point of vitrification, common salt is thrown into the kiln. The decomposition of the salt fills the kiln with dense fumes of salt vapour, producing on the wares a thin glaze of silicate of soda, exceedingly hard and thin, and revealing the least touch left by the etching or modelling tool. For "Doulton ware" this method was the first of the decorated styles introduced by the firm.

One of the striking peculiarities of the salt-glazed Doulton ware is that its decoration is entirely completed in the plastic state, a condition aud an advantage of this method, but the risk of spoiling the piece by denting or unduly moistening it is very great. The variety of the styles of ware, the beauty of form and colouring and the effective arrangement made a very pleasing picture. Almost every piece presents some different combination of work. The shapes are designed in the round, preliminary setting out upon paper is of little use and is not encouraged. The most important method is that of incising the ornamental pattern, the artist cutting into the clay with a sharp tool which throws up a fine burr on either side to retain the colour afterwards applied.

The distinctive features and process of manufacture of the different styles of ware were pointed out, including Silicon ware, Marqueterie ware, Carrara stoneware, Terra-cotta, Lambeth Faience, Vitreous Fresco, and stoneware polychrome, and a selection of terra-cotta panels by Mr. George Tinworth excited great admiration.

Before departing, refreshments were very kindly provided for the party by the firm, to whom a hearty vote of thanks was accorded on the proposal of Mr. T. F. Aukland, seconded by Mr. P. Boyd, R.N.R.

Ronald Trist & Co., Limited.—This enterprising firm is always to the fore in its specialities, and this is emphasized by the incisive manner in which the merits of the various commodities are placed before their customers. Among the commodities for which public appreciation has been shown we may mention the P.P.P. packing. This is readily accounted for by the fact that customers by the use of this packing have been able to save half the money usually spent in packing. Then we come to the packing now known as "Sea Rings," the use of which, it has been demonstrated, not only reduces the fuel bill but also the amount of wear and tear which takes place. Last, but not least, we will refer to the "Ruys" jointing material which does not cut hard, will not crumble or carbonize, will not burn out or blow out, and lastly, but by no means least, will not rot.

Sale of Warships.—A sale of obsolete warships was held recently at Portsmouth by Messrs. Fuller, Horsey & Cassell. Four vessels, three battleships and a wooden hulk were offered. The second-class battleship *Thunderer*, built at Pembroke and completed in the middle of the seventies, realized £19,500. It was during her steam trials that the terrible boiler explosion occurred in July, 1876, when forty-five men were killed. The battleships *Anson* and *Benbow* realized £21,200 each. The hulk *Defiance II.*, originally named *Perseus*, built of teak and oak, fetched £1425. The sale of the first three was subject to the condition that they are to be broken up in the United Kingdom within two years.

AUXILIARY MACHINERY ON BOARD THE NEW ORIENT LINERS.

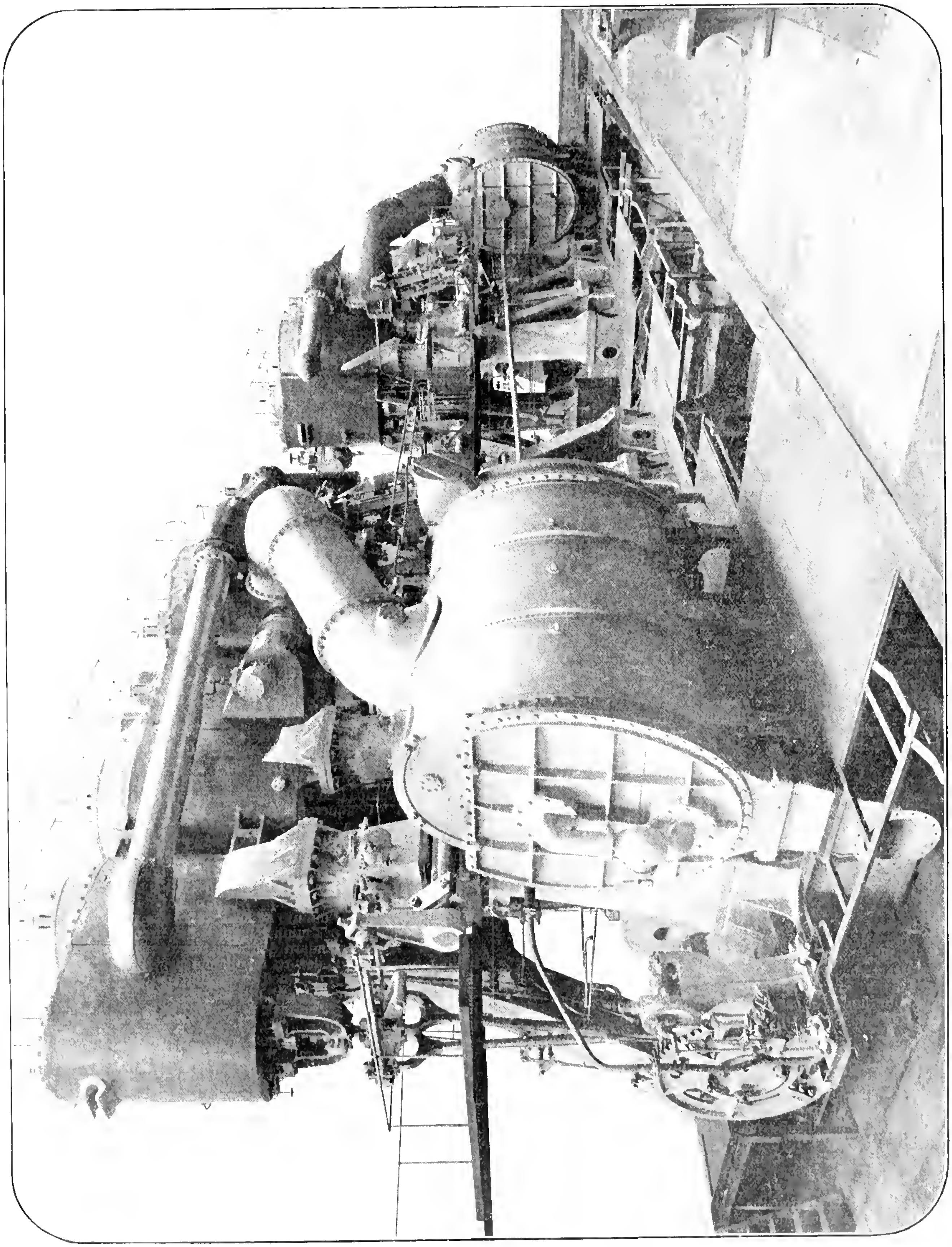
Of the five steamships, the *Orsova, Otway, Osterley, Otranto* and *Orvieto*, necessary to enable the Orient Steam Navigation Company to carry out the terms of their contract with the Australian Government for the conveyance of mails between the two continents, only one now requires to be tried for speed and handed over, *viz.*, the Belfast-built *Orvieto*, and this will shortly be accomplished. All the vessels are of the same general dimensions, and the three Clyde productions vary only in minor matters of accommodation, equipment and propulsive agents. The two Belfast productions differ more considerably from the others, not only in their deck arrangement, but also in the propulsive machinery.

The vessels afford interesting evidence of the growth of the modern practice of making the auxiliary machinery work independent of the main propelling engines. The air and all other pumps are worked separately, and advantage is taken of the ample electrical power on board to drive certain of the pumps by motor. Better balance in the main engines, and greater reliability in manœuvring, are points of advantage of the separately worked auxiliary system. With the pumps driven separately a vacuum can be depended on in the condenser irrespective of the working of the main engines. In this way the engines can be relied upon to start more easily from a state of rest.

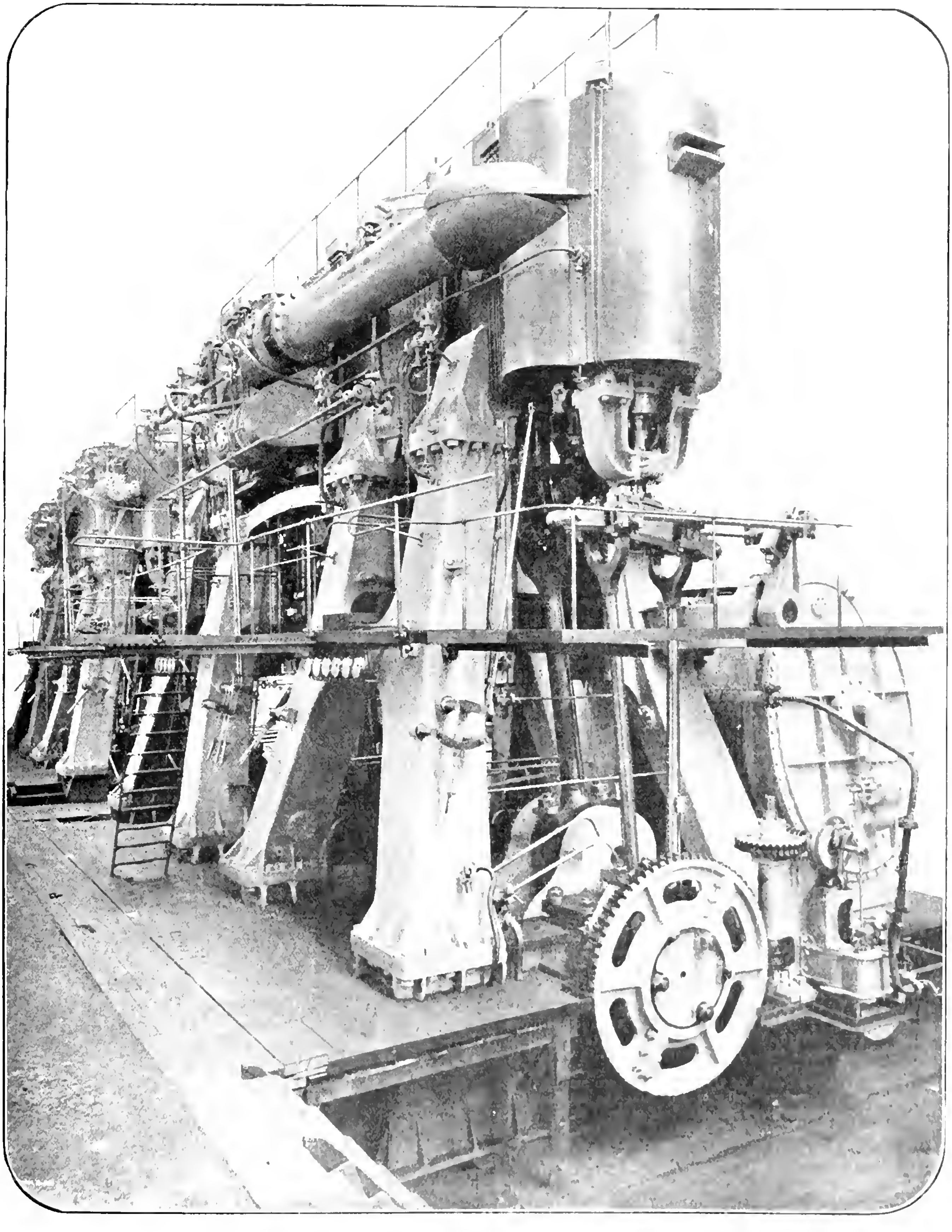
The propelling machinery consists of two sets of the latest type of quadruple-expansion engines, taking steam of 215 lbs. pressure from four double-ended and two single-ended boilers, arranged in two main groups, each in a separate compartment. The engines embody all the latest improvements, including balancing on the Yarrow-Schlick and Tweedy principle. The high-pressure cylinders are $28\frac{3}{4}$ in. diameter, first intermediate 41 in., second intermediate $58\frac{1}{2}$ in., and the low pressure 84 in. The stroke common to all cylinders is 60 in., and all have separate cast-iron liners and are steam jacketed. The valves admitting steam to the first intermediate and to the high-pressure cylinders are of the piston type, while those to the second intermediate and low-pressure cylinders are the ordinary flat slide valves, the latter having Joy's assistant cylinders. The valve gear is of the ordinary link-motion type. The crank shafts of ingot steel are of the built type, each being in two separate double-throw sections, the diameter being 17 in. and the pins 18 in. The thrust blocks are of the horseshoe type. The propellers have cast-steel boss and three manganese bronze blades.

The surface condensers are separate from the main framework of the engines and are circular in form, having a shell of wrought steel plating and cast-iron water ends. The circulating pumps (see Fig. 1) consist of two of Messrs. Allen's well-known "Conqueror" centrifugal type, having suction and discharge branches 22 in. diameter. The casings are of cast iron, fitted with gun-metal discs 45 in. diameter, having bronze spindles and carried in bearings external to the pump casing. Where the spindles enter the casing stuffing boxes are provided, having gun-metal glands and special provision for lubrication. Each pump is capable of delivering 9000 gallons of water per minute at load water line when running at 155 revolutions per minute, and is direct-coupled to one of Messrs. Allen's standard double-acting open type engines, having a single cylinder 10 in. diameter, with a stroke of 9 in. Each engine is designed to develop its full horse power when supplied with steam at 150 lbs. per square in. and exhausting against 15 lbs. back pressure. It is also designed for 215 lbs. boiler pressure.

The air pumps are of the well-known Weir twin type, each with two $9\frac{1}{2}$ in. steam cylinders 26 in. water cylinders and a stroke of 18 in., and they are placed immediately in front of the condenser on each side of the ship. The condensed water is discharged into a hotwell tank at a temperature of about 100 deg. Fahr. Two List & Munn's patent gravitation filters, made by Messrs. J. H. Carruthers & Co., receive the condensed water from the hot-well tank, whence it is pumped by a hot-well pump into a Weir direct-contact feed heater, and whence at a temperature of about 210 deg. Fahr. it is passed by the main feed pumps into the boilers. There are two main feed pumps and two spare feed pumps by Weir, all of which can be used to take water from the hot well



Engines of the Orient Liner "Otway." (Rear View.)



Engines of the Orient Liner "Otway." Front View.

or feed heater. A separate auxiliary feed pump of Carruthers vertical duplex type is fitted for use in port.

The outstanding advantage of the List & Munn gravitation feed filters, with which all the new Orient liners are fitted, is that there is no risk of forcing impurities through the filtering medium, as the pressure under which the filter works is only that due to a very small head of water—in other words, the water from the hot-well tanks is discharged at a height which gives sufficient vertical head to insure a steady flow through the filters. The surface provided is large and filtration is slow and sure, any oil and grease having time to be thoroughly deposited. The filters being open to the atmosphere, any air which may be in the feed water escapes before it leaves the filter tanks. These are so arranged that one can be cleaned while the other continues in operation; but in practice neither is opened during the entire voyage to Australia and are found to perform their duties satisfactorily during this long period.

Other auxiliaries supplied by Messrs. Carruthers are the ballast, ash ejector, fire, sanitary, fresh-water and general service pumps, some of which are illustrated in Figs. 2, 3 and 4 and all of which are of the duplex type. In addition to a duplex bilge pump of the ordinary type, Messrs. Carruthers also supplied a three-throw bilge pump driven by electric motor, Fig. 5. It is interesting for this reason, and for several novel features relating to the drive, the regulation for varying speeds and facilities for removing bilge wreckage from the interior of the pump in the minimum time and with least trouble. The motor driving this bilge pump is by Messrs. W. H. Allen, Sons & Co., and is of the variable speed semi-enclosed four-pole type, capable of developing 7 B.H.P. when supplied with current at a pressure of 102 volts and running at 1200 revolutions per minute. It can be reduced in speed in successive steps by shunt regulation to 600 revolutions per minute.

The sanitary pumps, which in the *Orsova* are of the turbine type, by Messrs. W. H. Allen, Sons & Co., and in the *Osterley* are of the centrifugal type, by Messrs. Drysdale & Co., "Bon Accord" Works, Glasgow, are electrically driven, the motor in each case being by Messrs. Allen, Sons & Co. The *Orsova's* pumps are of the last-named firm's "Conqueror" turbine high-lift type, having suction and discharge branches 4 in. diameter. Each pump is capable of delivering 12,000 gallons of water per hour against a total suction and delivery head of 70 ft. when running at a speed of 1200 revolutions per minute. The pump castings are of cast iron, the discs and guide rings being of high-tension bronze. The spindles are also of bronze running in two ring lubricated bearings, arranged outside the pump casings. The spindle of each pump is fitted with flexible coupling for direct coupling to motor, and the pump and motor are mounted on underneath baseplate, forming a very compact and neat plant. The motors are of the four-pole protected type easily capable of developing $7\frac{1}{2}$ B.H.P., when supplied with continuous current at a pressure of 102 volts. The motors are not of the totally-enclosed type, but are provided with covers to render them waterproof.

The six boilers in each of the new liners are arranged in two groups, in separate boiler rooms, and the products of combustion are led up separate tunnels of oval form. The boilers—which in the *Osterley* are 20 ft. 2 in. long, double-ended, 11 ft. 6 in. single-ended, and 16 ft. 6 in. diameter—have a total of forty furnaces of 40 in. inside diameter, all being of the corrugated type and giving, on 5 ft. 6 in. bars, a grate area of 680 sq. ft. The total heating surface is 31,370 sq. ft., and the working pressure of the boilers is 215 lbs. All the furnaces are worked under the Howden system of forced draught, for which purpose five large motor-driven fans are installed in separate rooms above the boiler rooms. These five forced-draught fans are of Howden's own make,

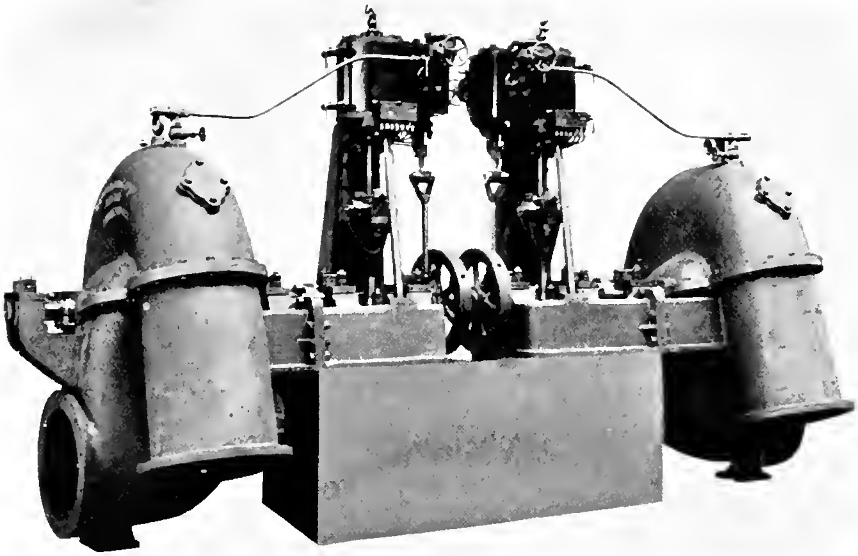


Fig. 1.

driven by electric motors by Messrs. W. H. Allen, Sons and Co., which are of special interest on account of being constructed so as to be entirely fireproof, and after long continuous running to have not deteriorated from heating.

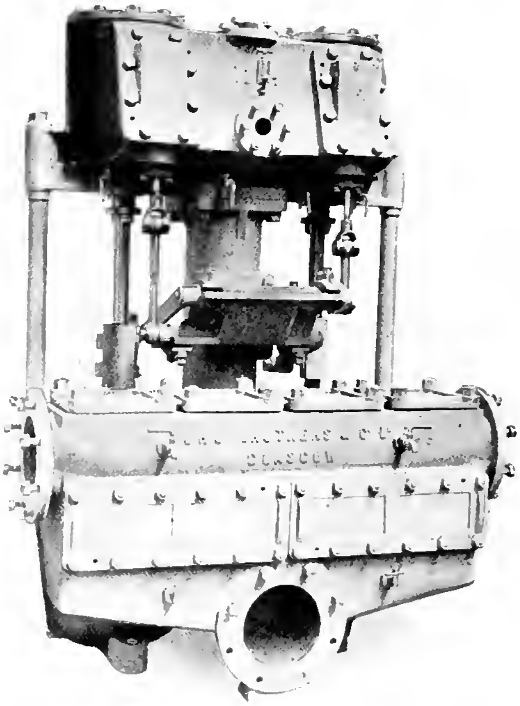


Fig. 2.

The insulation of the copper windings is ensured either by means of micanite or asbestos throughout. The motors are of the four-pole shunt-wound protected type, and are liberally designed to work for long periods with a minimum of attention.

It may here be appropriate to state that the arrangements for the natural ventilation of the stokeholds and engine rooms is of a specially efficient character, the air shafts, etc., to the skylight and open-ways on upper decks being of extra

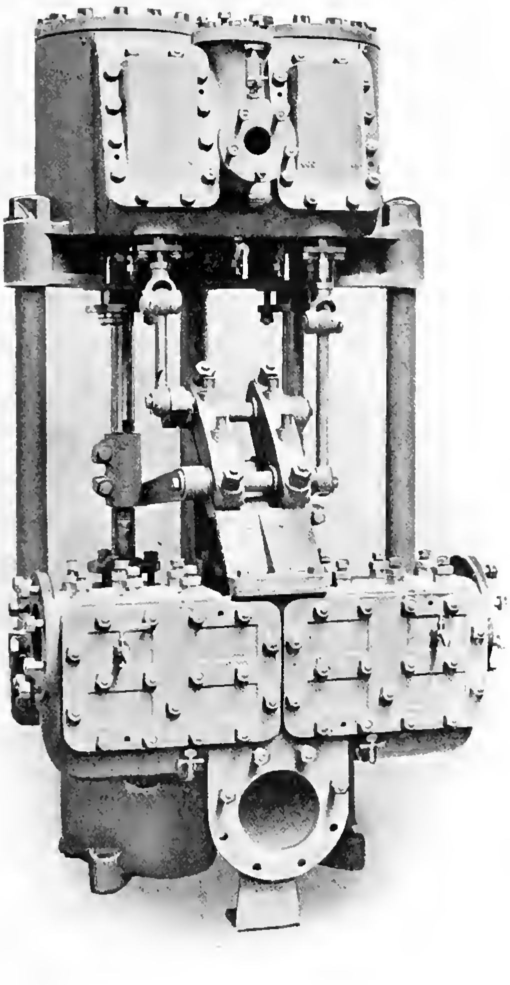


Fig. 3.

large area. A feature worthy of note in connection with the provision made for good working conditions is a passage-way for firemen along the side of the ship from the forward stokehold to the firemen's quarters forward.

Electricity, as will be gathered, plays an important part in the equipment and general economy of the new Orient liners. Electric driving is adopted, not only for certain of the engine-room auxiliaries, but, as will afterwards be seen, also for many of the items of deck machinery. It is however, of course, for lighting and ventilation that electricity is chiefly made to play its wonderful part. On board the *Orsova*, for example, the system of lighting involves no fewer than 1500 lamps, and for ventilation purposes there are 250 electric fans. The generating plant consists of four sets, Fig. 6, manufactured by Messrs. W. H. Allen, Sons & Co., Ltd., Queen's Engineering Works, Bedford. Each set embodies a compound wound dynamo direct coupled to a high speed enclosed engine and is constructed for a continuous output of 75 K.W. at 102 volts, when running at a speed of 420 revolutions per minute.

The engines of the generating sets are of the vertical enclosed double-acting two-crank type, and are fitted with a system of forced lubrication, the oil being circulated to all bearing surfaces by means of a valveless pump driven from the engine eccentric. Each engine has one high-pressure cylinder $8\frac{1}{2}$ in. diameter and one low-pressure cylinder 15 in. diameter, the stroke being 7 in., and they are so designed that the specified output of the dynamos is maintained when they are supplied with steam at 180 lbs. pressure per square in. in the high-pressure cylinder, and exhausting at a pressure of 20 lbs. absolute. They are further capable of standing full boiler pressure, *viz.*, 215 lbs. per sq. in. The cylinders with the two valve chests are cast together, a valve chest being on either side of the horizontal centre line and between the two cylinders, thus bringing the overall length of the engine within exceedingly moderate limits and ensuring at the same time a minimum distance between the cylinder centres. The high and low-pressure valves are driven from one eccentric forged solid with the shaft and situated between the cranks. The working parts are enclosed in a cast-iron trunk, with door giving easy access to the interior. The guide faces are cast in one with, and on the back of the trunk, truly machined and scraped, and provided with guide bars secured by screws. Effective oil scraping glands are fitted to the top of trunk, preventing oil passing up into the cylinders or water down into the crank chamber. The trunk is securely bolted to a massive bedplate forming a reservoir for the

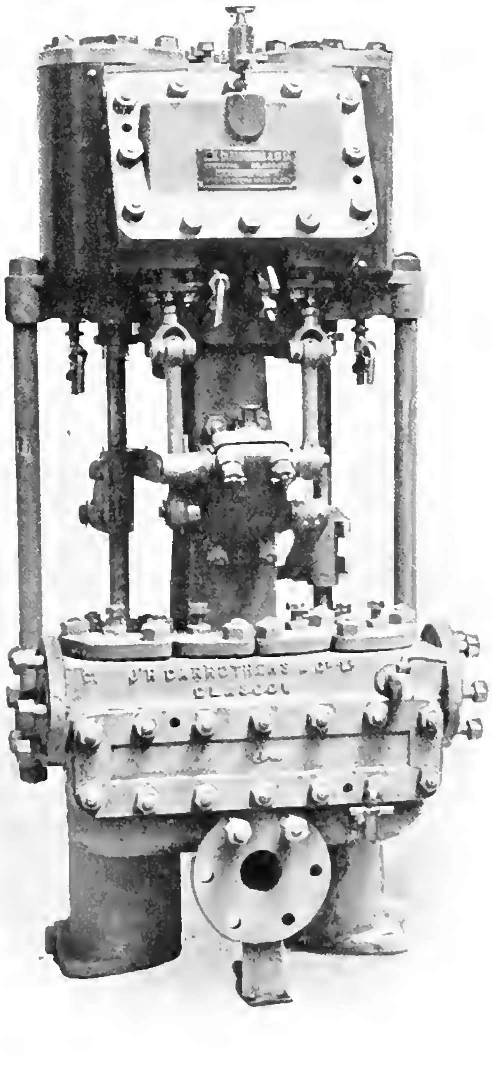


Fig. 4.

lubricating oil. The governors are of the centrifugal type fitted to the end of each crankshaft and connected to the throttle valve by means of a vertical rod and lever. A hand regulating spring is provided whereby the speed is capable of being varied 5 per cent. above and below the normal whilst the engine is running. The difference of

voltage is not more than 3 per cent. from full load to no load when load is suddenly thrown off. Forced lubrication is fitted to the governors the oil being supplied from a hole drilled through the end of the crankshaft, which distributes the oil to the governor spindle, from which two pipes are led to the moving pins and levers carrying the governor weights.

The dynamos are of Messrs. Allen's latest type with six poles, compound wound and self-regulating at all loads, constructed to run singly. Each dynamo is provided with six sets of carbon brushes, each set comprising six brushes. These brushes are of a special grade of carbon, most favourable to a sparkless running and each is efficiently connected directly to the brush box by means of a flexible copper pigtail, and has a separate pressure spring adjustable by a thumb screw. Should it at any time be necessary to remove and examine one of the brushes, this can be done whilst the engine is running. The outer bearings are automatically lubricated by means of oil rings dipping into oil reservoirs which are furnished with overflow pipes. Oil throwers are shrunk on the armature spindles to prevent waste oil creeping over the commutator surfaces. Each dynamo is capable of carrying an overload of 30 per cent. for half an hour without injurious heating or sparking.

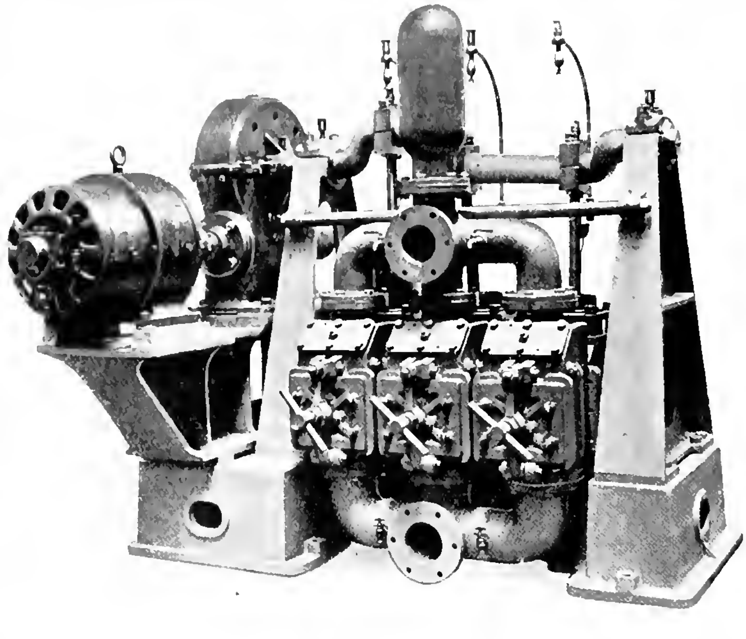


Fig 5.

In regard to deck machinery the new Orient ships enjoy a duplex equipment in the sense that steam and electricity are both used in driving the various apparatus and appliances. In steering the ship (the rudder being of the balanced type) the steam equipment is that of Brown's tiller gear, while in addition there is an emergency steam gear of the usual type fitted alongside, both of these being controlled from the forward or after bridge by telemotors. For working the anchor and chains there is a very powerful forward steam windlass and capstan, driven by vertical engines, to work $2\frac{13}{16}$ in. cables of Clarke, Chapman & Co.'s most improved direct-grip type. Two powerful warping capstans of the same firm's make driven by vertical engines, each 10 in. diameter by 12 in. stroke, are fitted alongside the steering house aft. For working cargo the vessels are fitted with six powerful horizontal steam winches, having cylinders 7 in. diameter by 12 in. stroke, and special heavy motion reversing gear and a lifting capacity of four tons each. In addition there are several winches driven electrically, the driving agent being a 20-H.P. series-wound motor. Winches have double barrels, driven by means of machine-cut worm and spur gearing. Each barrel can be run independently in either direction, and has warping ends fitted outside the side frame. Each of these winches takes a load of $1\frac{1}{4}$ tons at 120 ft. per minute or the same load on each barrel at about 90 ft. per minute. By

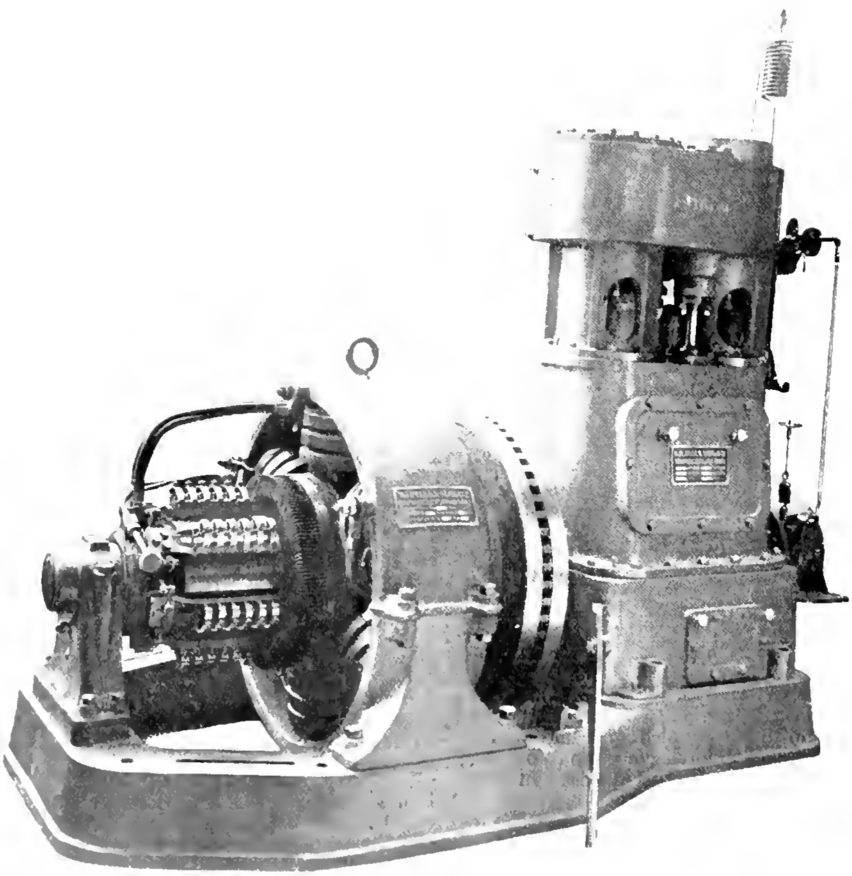


Fig 6.

sliding the slow speed pinion on the motor shaft into gear the load can be increased to four tons.

For dealing with general cargo of lighter description, and with passengers' baggage, etc., the vessels have also four $\frac{1}{2}$-ton deck steam cranes, and two $1\frac{1}{2}$-ton electric deck cranes, all being of Clarke, Chapman & Co.'s make. All have quick slewing gear so that they can swing round in a complete circle. The electric cranes, both hoisting and slewing motions, are worked by one motor, which is capable of raising a load of $1\frac{1}{2}$ tons at 120 ft. per minute, and slewing it at a radius of $19\frac{1}{2}$ ft. at a speed of 320 ft. per minute.

The cold storage accommodation on the new Orient liners is, in accordance with the terms of the mail contract, very extensive, and all the arrangements in connection with this feature are the result of most careful consideration of all the conditions to be fulfilled. The insulated holds for perishable cargo, and the cold storage chambers for ship's provisions, together with the mechanical provision for keeping the compartments at the freezing temperature, are all on well-devised and thoroughly up-to-date lines. The large insulated holds in each ship have a combined capacity of about 90,000. In addition there are two small chambers of 46 and 11 tons capacity respectively for carrying provisions at or below freezing point which may be required on the voyage.

The refrigerating machinery is forward of the boiler compartment, and consists of two of Haslam's compound dry-air machines (see Fig. 7) of a capacity of 85,000 cubic ft. each with a CO^2 machine of a refrigerative capacity of 15 tons. Each dry-air machine is entirely self-contained, having its own condenser, while the CO^2 machines exhaust into the auxiliary pipes, which may discharge into the main or auxiliary condenser. The adoption of a combination of dry-air and CO^2 plant in preference to a complete CO^2 installation, has evidently been the result of careful considerations. While the latter involves a less consumption of fuel, the loss in cargo-earning under certain conditions, owing to the greater space occupied by the brine pipes in the hold, may more than outweigh the increased expenditure on coal. Air cooling is now being adopted even with the CO^2 machine, the air being cooled by passing over the brine pipes. Where the maintenance of flavour is an important consideration, and where butter, apples, cheese, etc., have to be carried in close proximity to each other, as in the case of the ship's provision chamber, the brine system has many advantages, and hence the duplicate system adopted in the Orient liners.

The dry-air machine is worked to insure a temperature of 80 deg. Fahr. at the machine, whence it passes to the hold. To prevent the cold air gravitating to the bottom of the hold and remaining there, large fans are fitted driven by compound steam engines, which exhaust the air from refrigerative holds, and improves circulation. These fans are located above the insulated holds and discharge into the trunks between the dry-air machines and the holds. This mixture of comparatively warm air with the cold air from the machine increases the volume about tenfold and raises the temperature correspondingly, the total cooling effect of the plant being the same. The result is that the air is discharged at a temperature about freezing point, and thus there is no fear of a deleterious effect on the cargo due to freezing. The fans, at the same time, afford a better circulation of air in the holds and maintain an equable temperature throughout.

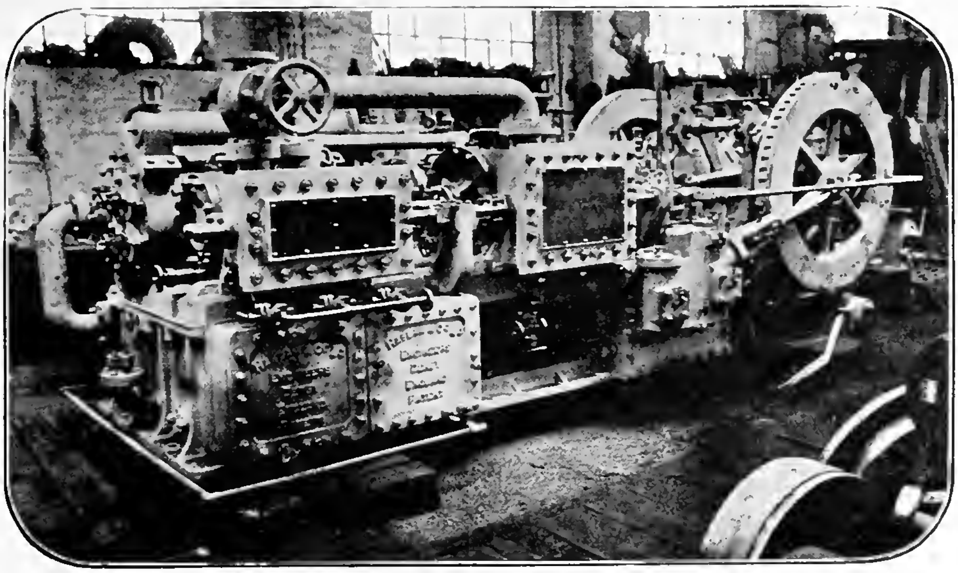


Fig. 7.

The "Nimrod."—The famous exploring vessel *Nimrod* has not only added her name to the list of vessels which have made positive discoveries by enabling Lieut. Shackleton and his gallant co-adventurers to penetrate further into the unknown Southern ice than any previous explorers. She has on her homeward voyage added to the world's geographical knowledge by her disproval of the existence of three reputed islands in the sub-Antarctic seas. The islands whose alleged existence she was charged to examine into on her homeward trip were the Macquarie Island, Emerald Island, Dougherty Island and Nimrod Island, the legend of whose position has been more or less accepted for many years. About the reality of the first-named there can be no possible doubt, and the *Nimrod's* crew actually landed on it, but as regards the other three excellent proof of their non-existence, as, though she sailed over their alleged position, the exploring ship failed to find any trace of any of them. These facts were cabled home from Monte Video by Captain Davis of the *Nimrod* when he called there early in July on his way back to the Thames. It may be interesting to mention that the *Nimrod* saw much active service before she became engaged in Antarctic work. She was formerly in the fleet of Messrs. Job Brothers, of Liverpool and St. John's, Newfoundland, and under their flag was engaged in seal fishing so that her acquaintance with ice is of old standing.

The New Zealand Shipping Company's steamer *Orari* has recently sailed from Wellington with £62 100 gold for London.

REFRIGERATING INSTALLATIONS, WITH SPECIAL REFERENCE TO THE ARRANGEMENTS NECESSARY WHEN NARROW LIMITS OF TEMPERATURE ARE REQUIRED.*

By Mr. ROBERT BALFOUR, M.I.Mar.E.

It is with a certain amount of diffidence that this paper is presented, being, as I am, fully cognizant of the fact that other members of this Institute have as wide an acquaintance with the subject, and some, doubtless, a far more extensive experience, than I have in the particular branch of refrigeration with which I propose to deal.

Having had, however, for some years past the special privilege of inspecting a majority of the vessels which are engaged in the carriage of refrigerated cargoes trading to this country, I purpose on this occasion to bring under notice a few points, in connection with the carriage of commodities which require to be subjected to the influence of what may be called a moderate rather than a low temperature to ensure their preservation in good condition, and it is hoped that the ventilation of the subject by the subsequent discussion will prove mutually beneficial.

A reference to the register book of Lloyd's Register of British and foreign shipping will show that there are a large number of steamers engaged in the carriage of refrigerated cargoes from Australia, New Zealand and South America. It is usual to denote their carrying capacity by the number of carcases of mutton they can bring; some of the individual vessels can carry as many as 150,000 carcases.

Mutton, however, which is always carried in a frozen condition, is not the only commodity these vessels bring to this country, as large quantities of beef, rabbits, butter, etc., are also brought over frozen, and in addition a very considerable and increasing quantity of beef is brought from Argentina under what is known as "chilled" conditions.

Considerable development has undoubtedly taken place during the last eight years in connection with this special industry, as is shown by the figures quoted below, which give the amount of chilled beef imported into the United Kingdom from the River Plate alone, between the years 1901 and 1908 inclusive.

The following figures are taken from the *Reviews of the Trade*, published by Messrs. Weddell & Co.:—

1901.	Chilled beef.	24,919	quarters.
1902.	,,	94,498	,,
1903.	,,	142,542	,,
1904.	,,	198,300	,,
1905.	,,	402,195	,,
1906.	,,	454,613	,,
1907.	,,	427,042	,,
1908.	,,	766,284	,,

These figures practically cover the period from the outbreak of foot and mouth disease in the Argentine, and the consequent closing of the English ports to live stock from the River Plate.

Chilled beef had, of course, been imported from the United States of America for many years previous to 1901, but under entirely different conditions of carriage.

It may be mentioned that up to the present the attempts to carry chilled beef from the Australian and New Zealand Colonies have met with but little success; consequently, the experiment which is now being made to bring a large consignment from Queensland is being anxiously looked forward to. In connection with this it may be mentioned that a very experienced engineer has been specially selected to take charge of this cargo from the initial stage until its delivery in this country, so that if failure occurs it will not be owing to lack of skill or to want of attention to the minutiae of detail necessary for success.

At the present time there is a still further development of this particular industry, arrangements being made for much larger cargoes being carried in individual ships.

*Read before the Institute of Marine Engineers on July 24th, 1909, in the Congress Hall, Imperial International Exhibition, F. H. Green, Esq., in the chair.

It is mainly to the necessary conditions for the successful carriage of "chilled" beef that this paper is devoted, although when dealing with the purely mechanical part of the subject the principles involved in maintaining a practically uniform temperature in large compartments for long periods will be seen to be applicable to the carriage of some fruits, cheese, etc., which also require to be held during the voyage at a definite temperature with no appreciable variation.

Refrigerated cargoes of all kinds are subjected to numerous risks beyond the ordinary perils of the sea. These have been well dealt with by Mr. W. Lund in a paper prepared for the recent International Congress du Froid. How real some of these risks appertaining to "chilled" beef are, and what is done to meet them, this paper is intended to demonstrate.

Mr. Lund shows that incessant care is required from the moment the live animal leaves its pasturage, through the time when it is conveyed to the abattoir, in the process of slaughtering, preparation and cooling of the carcase, loading into the vessel, transit over seas, unloading from the vessel, during marketing and right up to the time when it arrives at the retailer's shop, and that failure at any one of these numerous stages may have serious consequences, which, although not apparent at the time, will show themselves at a later stage.

In order to clearly appreciate why it is that *cold* is preservative of fresh meat we must first determine what it is that leads to the putrefaction or decay of meat under ordinary conditions. There is now no doubt that the changes which take place in lean flesh are due mainly, if not entirely, to two specifically distinct sets of conditions, *viz.*, the action of bacteria or fungi, and that of enzymes. Of these the best known is that of bacteria and moulds or fungi, which are organisms living under suitable conditions upon the tissue of the meat, developing with extreme rapidity when the surroundings are favourable. "Enzymes" is the name given to certain ferments or active principles which have the power of modifying organic substances by either breaking them down into more simple substances, or by changing them in some way from their original form.

The gastric juice of the stomach and the pancreatic juice of the spleen are examples of enzymes at work in aiding digestion, etc., in animal bodies, and certain changes which take place in flesh of dead animals when neither bacteria nor moulds are present, are considered to be due to the actions of enzymes, of which there are several distinct sorts.

There is no doubt that for each sort of enzyme and for each variety of mould and bacteria there are certain conditions under which it develops and acts with the greatest activity, and other conditions under which it either acts very slowly, becomes altogether dormant, or even dies. Experience shows that mutton and some other commodities can be held for many months when frozen hard without any appreciable change, due either to bacteria moulds or enzymes, and also shows that under certain conditions beef also can be held for several weeks when kept at a temperature of $29\frac{1}{2}$° F. without appreciably losing its freshness, flavour, or other qualities.

Much information upon these matters is contained in the invaluable papers contributed to the Congress du Froid by Drs. Pennington and Richardson, of the United States of America, by Dr. Rideal and Mr. Tabor, of London, and I shall quote from these authorities matters which ought to be appreciated by all those interested in the question of "chilled" beef.

First as to the effect of cold upon the enzymes found in the meat. Dr. Richardson says: "Beef juice is a liquid containing several salts and other substances in solution. When its temperature is lowered continuously below 32°F. it is found that a small quantity of ice crystals separate out at 31°F. As the temperature becomes lower more ice separates and the remainder of the juice becomes more concentrated; at a temperature of 16°F. the juice becomes mainly ice crystals mixed with a gummy viscous concentrate. At somewhere about —22°F. this freezes solid. This point, where complete glaciation takes place, is called the cryohydric point." He considers from theoretical grounds that bacterial growth and probably enzyme action both cease at this temperature. Dr. Pennington states that at 14°F. enzymes are still able to function, though their action is greatly retarded. Dr. Richardson, however, states that his analyses show that peptonizing enzymes are not active at ordinary freezing temperatures

(in his experiments 16°F. to 11°F.). From these statements it would appear that some change may be expected to take place with the lapse of time, even when the ordinary refrigerating conditions prevail, and we must attribute to the enzymes the changes, other than desiccation, which take place in chilled meat under conditions of complete sterilization when neither bacteria nor moulds are present.

When we come to consider bacteria, scientists recognise an immense number of kinds, some harmful, others the reverse, but all necessarily effecting changes in the structure or composition of the pabulum upon which they live. Most of them thrive best at ordinary temperatures, but some of them appear to require low temperatures. Dr. Collingridge, the Medical Officer of Health of the City of London, says in his last report : " Hitherto it has been commonly believed that the freezing of meat properly carried out will ensure its preservation for an indefinite period, disregarding altogether the fact now well established, that there is a distinct class of bacteria which live and flourish at the low temperatures of the freezing chamber."

Dr. Pennington makes the following statements :—" Organisms have been found in Norwegian glaciers, and they develop rapidly at the freezing point.

" We now recognise a group of organisms which, because of their ability to flourish at temperatures that but a short time ago were considered to be prohibitive to life process, have been called 'rhigophile' bacteria. These organisms are found to be widely distributed and of common occurrence in milk, flesh and spring water.

" These low temperature organisms are found to inhabit slaughter houses and cooling rooms and to infect flesh hung in them, with a consequent production of flavour in the meat.

" Milk maintained at 29°F., which is sufficiently cold to cause a mass of ice crystals to form, not only fails to kill organisms, but permits a fairly rapid development of bacteria Even at 2° F. to —9° F. there has been observed a certain amount of growth in frozen cream."

" If organisms are provided with their natural environment they will multiply when the medium is in a frozen condition."

Dr. Rideal, speaking of the fungus of " brown spot " on chilled beef, says : " It does not grow at blood heat, but grows at ordinary temperatures and as low as 28° F., but at 16° F. there is no growth of this fungus."

Dr. Richardson, however, seems not to hold quite the same opinions as the before-mentioned authorities as regards the growth of bacteria at low temperatures. He says, as before quoted, that " bacterial growth ceases at the cryohydric point of beef juice ;" also that " in a solid rigid medium growth and reproduction of living things become impossible," and that " the fact should be emphasized that it is the solid state of the medium and not any specific temperature which is the limiting condition for growth and reproduction, although retardation of growth ensues with lowering of temperature."

Even if there is some doubt as to the growth of bacteria upon absolutely solidly frozen meat, it will be seen that there is none whatever as to the possibility of both growth and reproduction at the " chilled " temperature at which the beef is not at all frozen, all the authorities being agreed on this point.

It is also important to note that although low temperatures may prevent growth, they do not destroy vitality, and that when the temperature becomes suitable, growth and reproduction again become active. On this point we have the following evidence.

Dr. Rideal states that Pictet and Young cooled some species of bacteria down to 202° F., the entire duration of the test being forty hours, after which growth was recovered on thawing ; also that Macfadyen and Rowland subjected a number of varieties of bacteria to—421° F. for six hours without killing them, and subsequently several species to the temperature of liquid air for six hours without impairing their vitality.

Dr. Pennington also quotes Macfadyen, that some bacteria are still capable of reproducing and carrying out a complete life cycle after being maintained for days at temperatures as low as —310° F.; also, when speaking of an experiment made after seventeen months' cold storage in a frozen condition, says : " It is a proof of the fact that organisms can survive for long periods at temperatures far below the congealing point, and that growth is prompt and vigorous when a suitable environment is provided." Again : " Though the multiplication of bacteria at low temperature is still in some respects an open question, their vitality for at least four years at 14° F. is a fixed fact."

Mr. Tabor evidently considers that as regards moulds, the sporangia of which are ever present in the air, changes of temperature facilitate their growth. He says : " A rise of temperature, even when the rise has not reached the freezing point, undoubtedly facilitates the growth of mould, and fluctuations well within the limit of 32° F. are generally productive of damage by mould and afterwards most certainly of considerable growth of fungi, even if the temperature be reduced to the former level." And again : " It is useless to talk of the advisability of lowering the temperature of the chambers. These low organisms once started will grow at a temperature even so low as to be fatal to the goods."

In face of this array of evidence of the uudoubted risks in holding chilled beef, even when the temperature is correctly kept at the proper limits, 29½ to 30½° F., it may be wondered at that any cargoes ever get satisfactorily delivered, and the fact that they are so delivered speaks volumes for the care with which all the necessary conditions have been recognised and provided for.

There is another point to which Dr. Collingridge draws attention in the report already quoted, *viz.*, that of the condition or quality of the beef itself. He says, speaking of the chilled beef imported during the year : " Much of the beef has been better made up for slaughter, and it is most interesting to note that if a cargo is out of condition it is generally a poor lot of beef ; if a few quarters amongst a lot are out of condition, those are almost invariably the weakest and thinnest ; hence it seems fair to argue that if the beef is to arrive in good condition it must be beef not lacking in substance to begin with."

Dr. Pennington's remarks as to the organisms found in slaughter houses and cooling rooms point to the imperative necessity of cleanliness in the abattoirs and freezing and storage chambers, even if they do not call for absolute sterilization of these places and of the wrappers with which the meat is covered.

Regarding sterilization Dr. Collingridge says : " Some reference was made last year to the Linley System of preserving beef in sterilized air. Several vessels have been fitted up with the necessary apparatus, and whenever it has been properly selected aud well handled it has arrived in a condition which argues that the system has many advantages, but whenever beef of indifferent quality has been shipped it is too much to expect that any method of preservation will make it into desirable meat."

In the Linley system the chilling chambers at the works are sterilized by Formaldehyde vapour, as also are the refrigerated holds before loading is commenced, and the air in them is sterilized immediately after loading is completed. Afterwards the air, which is kept circulating by mechanical means, is regularly passed over prepared surfaces to keep it dry and sterile.

Dr. Rideal in his paper mentions another system, that of Messrs. Houlder Bros. & Anderson, in which the chambers are also sterilized before loading. After loading the air is renewed every eight hours by means of an exhaust fan, whilst at the same time fresh air cooled to the proper temperature is supplied. This system required great care in the admission of the fresh air owing to the varying temperature of the outside atmosphere. Although some very successful voyages were made in cases where it was adopted, it is understood that the system has now been abandoned.

This appears to be the proper place to mention that to a large extent the success which has been attained in the refrigerating industry of the world is largely due to the seagoing engineer. He has been from the commencement, and is to-day, intimately connected with its development at practically every stage, and the most successful engineers now engaged on shore in the industry have obtained their skill and experience on board the vessels which are not only carriers, but also immense storehouses during the time of their voyages through tropical climates.

In the first place, to ensure success the meat must be properly prepared for shipment, and for this the works, which necessarily are usually in outlying districts, must not be liable to any stoppage whatever ; they should therefore be so equipped with tools and appliances as to render it possible for any breakdown of the refrigerating machinery which may

occur to be promptly dealt with by their own staff, which should include, besides a very experienced chief engineer, two or three skilled assistants who ordinarily keep watch and watch about, to all intents and purposes as on board ship; the necessary resourcefulness and experience for dealing promptly with emergencies appears best to be obtained by service at sea.

Most meat works are well equipped, and in some places even the necessary plant has been supplied to enable satisfactory castings to be turned out.

The process of preparing chilled beef is as follows, after the animals are killed and dressed:—

The meat is hung in a cooled space (having been run along overhead rails from the slaughter house) for some hours, so as to accumulate a sufficient number of carcases to fill a chilling room.

When the chilling room is filled the doors are closed and the cooling started, and in order to abstract the animal heat gradually from the carcase, the meat is allowed to remain in the chilling-room for as near as possible twenty-four hours, the air temperature being kept at not less than 31° F. Then follows the cutting of the sides into fore and hind quarters. A selection is then made, the best only being kept for "chilled" meat. Most of the fore quarters and the unselected hinds are then put into a freezing-room and frozen hard. Those selected for chilling are put into a refrigerated store, or deposit, and held with an air temperature about 31° F. until required for shipment. At first, owing to the thickness, there is still some heat left in the heart of the meat, and this is gradually removed in the cooling store without the temperature of any part of the meat being allowed to fall below 30° F.

The beef must never be subjected to frost, *i.e.*, no part of the moisture in it should ever be solidified. Should this occur even to a slight degree, the structure of the meat is burst or broken, and on regaining the thawing temperature the meat juice will not again absorb the now thawed ice, the meat itself will present a flabby appearance, and the moisture will run freely from the cut surfaces, with the result that the meat, although perfectly wholesome has much depreciated in value.

As examples of the difficulties in dealing with chilled beef it may be stated that the animals must not be excited or harried immediately preceding slaughter, so as to put them in even a slightly feverish condition, or should their joints be sprained or dislocated through slipping whilst being driven into the stockyard, local inflammaation is likely to result, and the joint oil or lubricant will in consequence become decomposed. In either case it is found that the keeping qualities of the beef are much restricted, as they are also when the weather conditions existing at the time of slaughter are thundery or sultry, or when the atmosphere is heavily charged with moisture.

From what has been said as to bacteria and moulds it is easily realized that difficulties have to be contended with owing to the atmospheric conditions and surroundings of the meat works where large numbers of animals are collected for slaughter (a stockyard being a place which must under any condition be simply teeming with organic matter).

In addition to this there is to be considered the condition of the men, their clothing and the implements used, none of which are sterile; also on the hide being removed whilst the animal heat still remains in the carcase, the warm moist flesh is particularly susceptible to the action of any germs which may settle on it. In short, it would appear that the ideal slaughter house should be, as regards sterilization, on a par with the operating theatre of a modern hospital. This, of course, is practically impossible, but various systems for sterilizing the surfaces of the meat have been attempted with oxygen, carbonic acid, chloroform, ozone, etc. All these, however, have failed to be a commercial success, notwithstanding the good results attained in what may be termed laboratory experiments. Probably because sterilization is not generally employed where it would be most useful, *viz.*, in the works, and possibly also because of the fair measure of success which has been obtained without it, the majority of the shipping companies engaged in carrying this special commodity are content to adhere to the ordinary methods of cleansing the chambers before receiving the cargoes.

In handling chilled beef, critical stages occur during the transit of the meat from the works to the ship, and from the ship to the shore. This is in some cases effected by means of trucks or barges, and whilst the meat is being loaded therein it is often exposed to the warm and moist air for a considerable length of time. It may, however, be mentioned that in the River Plate some of the barges are fitted with refrigerating appliances, which minimizes the risks involved at this stage.

It sometimes happens that a consignment in itself is not of sufficient quantity to completely fill the insulated space in which it is placed; this involves the reopening of the chamber to receive another parcel, which may be at a comparatively higher temperature than the first, and also the entry of warm air into the chamber, the moisture in which will be deposited upon the colder surfaces of the first consignment of beef, and mould may then be looked for at a later period.

We will now consider the mechanical side of the question, *viz.*, how the necessary uniformly low temperature is maintained.

In the early stages of carriage of chilled beef from the United States of America the cooling was effected by the use of ice and salt. This frigorific mixture was pumped through galvanized pipes arranged along the sides of the cargo chambers, and after parting with its "cold" was discharged overboard. The insulation and the provision for hanging the meat in the chambers were of the crudest type.

Later, another and better method was adopted for keeping the necessary low temperature in the chambers, and special regard was paid to the value of insulation. Ice and salt were also used as in the former case, but instead of the mixture being circulated through pipes, flat tanks were fitted at intervals around the chamber, and these were kept charged with the crushed ice and salt by an attendant during the voyage. The meat was hung on bars supported by coach screws secured to wood grounds bolted to the deck beams. These installations were in some degree successful on short voyages, but the waste of space owing to the necessity of carrying large quantities of salt and ice was very great, and the method was certainly inferior to those now adopted, where the cold is produced by refrigerating machinery, and distributed by the brine circulating system, a method which has permitted the successful carriage of chilled beef from the more distant ports of South America.

The refrigerating appliances mostly in use for this special trade have the machinery constructed either on the carbonic anhydride or on the ammonia compression system, with the distribution of cold effected by the circulation of brine through numerous grids fixed under the overheading and along the sides of the insulated chambers. As the vessels have to carry either frozen or chilled meat, according to the cargo offering, the appliances have to be arranged suitably for either. Generally when "chilled" meat is being carried in some compartments, frozen produce is at the same time being carried in some other parts of the vessel.

In the older vessels this was satisfactorily accomplished by setting apart one or more machines to work exclusively on the chilled chambers, and others working exclusively on the frozen chambers. The control of each set of chambers was therefore independent, and the adjustment of the temperature of the "chilled" compartment was effected by regulating the flow of brine through the system of piping in it. This was found to be difficult. It did not lend itself to a quick and accurate adjustment of the brine temperatures. It was attempted to regulate the cargo compartment temperatures by controlling the quantity of brine flowing through the various grids. The objections were so serious that the present system, to be afterwards described, was introduced, and this is found to leave but little further to be desired.

When the cargo is once properly stowed and the hold cooled uniformly to the desired temperature, all that the refrigerating appliances have to do is to maintain the condition by abstracting the heat which flows into the spaces from the outside and the small quantity of heat which still remains in the thickest part of the meat forming the cargo. Heat under ordinary conditions flows in gradually all over the whole of the surface of the insulation, so that in an ideal construction the grids should be uniformly spread all over the insulation and should be kept uniformly at a temperature a little below that of the compartment so as to neutralize the heat travelling through the insulation, but they should not be so cold as to appreciably lower the temperature

of the air in the hold. These ideal conditions cannot be met, but an approximation to them can be. The portion of the grid where the brine enters is at the temperature of the incoming brine, at the exit the grid is warmer by the amount of heat extracted by the brine in its circuit. If the quantity of brine circulated is small, the abstraction of a definite amount of heat raises its temperature more than will be the case where the quantity circulated is larger. What is done, therefore, is not what was attempted in the older installations, *i.e.*, to regulate the quantity of flow of cold brine to suit the conditions of heat abstraction, but to circulate continuously through all the grids the maximum quantity of brine, and to carefully adjust the temperature of this brine to the precise degree which is found to exactly meet the requirements. The brine inlets and outlets in the chambers should be widely distributed in order to avoid concentration of low and high temperatures.

There are no grids fitted on the bottoms of the chambers, yet some heat enters them from these surfaces. This necessarily warms the air in contact; the warm air being lighter rises, the air cooled by the overhead grids is heavier and falls, and thus the difference in temperature between the grids and the bottom insulation produces continuous convection currents which provide the air circulation necessary for keeping the cargo in condition.

Now the expansion of air is only $\frac{1}{492}$ of its bulk for each rise of 15° F. in temperature; it is therefore seen what a small motive power there is to induce these convection currents if the particles of air as they leave the grids are only 1° F. colder than the warmer particles leaving the surface of the insulation. However, where the depth of the compartments is moderate, as it is in most 'tween decks, and where the cargo is so packed as to afford plenty of air spaces round each quarter, experience shows that a sufficient circulation can be obtained. Now that much greater depths of spaces are being utilized, carrying three or four tiers of quarters against the one or two tiers previously carried, it is probable either that more difference of temperatures will have to be made use of, or else mechanical means of air circulation employed.

Further, as it is necessary that the air cooling should not permit of small streams of air cooler than 29½° F. falling on any part of the beef in case of local frost, it will be seen that the grids themselves must not be kept at much lower temperatures than this, and as the cooling effect of any surface increases rapidly with differences of temperature and conversely decreases rapidly as the differences of temperature decrease, it is seen that a much larger cooling surface must be provided for "chilled" than for "frozen" conditions, even although less total heat has to be extracted.

With regard to the natural or convection circulation amongst the cargo, too much consideration cannot be given to the methods of stowing the cargo. "Chilled" meat is "hung." Each quarter should have a free air space all round it. Hinds present no difficulty on account of their shape. Each quarter is separately hung from a hook in the hock. Even when they are hung as closely as possible they only touch at the points where they are thickest, and there is plenty of space for air circulation. With fore quarters, however, it is different. They possess a more uniform section, and when they are hung, convex packing into concave, it is quite possible to pack them so closely as to seriously affect the air circulation amongst them. This will be especially important where more than one or two tiers are carried. The saving in space effected by close packing is dearly bought if it involves greater risk in such a valuable cargo as "chilled" beef.

It may be mentioned that the fore quarters are hooked through the ribs. When more tiers than one of quarters are carried, the upper tier is hooked directly on to the carrier bars which are bolted to the beams, and the other tiers are hooked with galvanized iron chains which swing from the carrier bars.

The rolling of the vessel in a sea way would set all the quarters swinging and abraiding one another unless the packing is so arranged to prevent any but the smallest movement. This is important as it is considered that some mould germs only take root on the dry surfaces of chilled meat when they are rubbed in with considerable mechanical force. Care has also to be taken with the stowage to ensure that the meat is never in direct contact with the brine pipes, stanchions, etc., or with the side insulation, and also to provide for a free flow of air all round it.

Returning to the question of the circulation of the brine at the precise temperature which is required; this is now carried out by what is called a brine mixing arrangement.

Two systems are in use, differing in detail, called respectively the open and the closed cycles. In both it may be said that the brine is circulated independent of the evaporator or cooler. The return brine as it leaves the chambers has a small quantity of very cold brine direct from the evaporator added to it so as to bring the temperature of the mixture to the precise point required, an equal volume of the brine being automatically taken out of the circuit by an overflow. In the "open" cycle the returns from each separate circuit is visible. It can be seen whether the full quantity is flowing in each section, and the temperature of each can be determined promptly so that some idea is obtained in the brine-tank-room as to the state of affairs in the hold. In the "closed" cycle there is practically no aeration of the brine, a point upon which some engineers lay great stress, and when the pipes are once thoroughly filled and absolutely free from air they are kept so, with no fear of their becoming air-locked and of the circulation becoming defective in consequence.

It is important to note that Lloyd's Rules state that brine pipes should not be galvanized on the inside. It has been found that where the brine comes into contact with the zinc of the galvanized surface the zinc becomes oxidized and free hydrogen gas is liberated. With plain iron pipes the same thing occurs, but in a much less degree. The only object of galvanizing is to protect the pipe from oxidation. It is thought by some engineers that the oxidation does not come from the calcium chloride employed for the brine, but from the air itself in the aeration of the brine in passing from the returns into the open tank and through the pumps, mixer, etc., and it is claimed that where the closed cycle is used there is no aeration and therefore no oxidation, besides which if any gas does become generated it cannot escape into the refrigerating room, where it would be a source of danger, but it escapes from a special ventilating pipe provided in connection with the closed cycles.

Regarding the question of oxidation it is thought by many experienced engineers that calcium chloride brine made with the commercial salt and fresh water does not possess corrosive properties, and that where corrosion is found it can always be traced to an admixture of sea water introduced, possibly at sea when additions to the brine have been made. A simple test which can be applied to any sample of brine to ascertain whether it is corrosive or not, is to immerse in it a piece of bright iron, which will not show any evidence of corrosion after many days' immersion in good brine made with fresh water.

Where internal galvanized pipes are insisted upon, the system should be efficiently ventilated, and during the first twelve months at least after starting the plant to work, it should be made a rule to circulate the brine throughout all the pipes at least once every two days; this will prevent the accumulation in the pipes of any large quantities of gas.

It is a matter of great importance that the means of ascertaining the temperatures in the chambers should be simple and correct.

In dealing with frozen meat, which can be carried quite safely at a temperature of anything below 15° F., the necessity of being able to ascertain the actual temperature in the chambers to within half a degree does not arise. With chilled meat, however, it is quite another matter. Here the range of temperature permissible is extremely limited, and it is of the utmost importance that the accurate degree of cold in the chambers should be known. The means, therefore, of being able to read such temperatures must of necessity be very exact.

It is known that with some thermometers the indications rise very quickly the moment the thermometer is drawn from the chamber, and the spirit or mercury can be seen moving up immediately the thermometer is drawn. To obviate this it has been found necessary to use a heavy wood casing round the thermometer bulb and stem; this resists the entry of heat and enables the thermometer to be read before the outside temperature has commenced to affect it.

Numbers of designs of thermometers have been tried, but it has been found that a stout wooden casing enables the thermometer to retain the temperature of the chamber very much better than than metal casings. Thermometers should be occasionally carefully compared with a Kew Standard and only such thermometers as are correct should be used.

It should be remembered that all new thermometers slowly alter, and, therefore, until they are at least two years old the verification with the standard should receive periodical attention. They should be graded on the stem, as well as on the wood case, in ½ degrees within a range of, say, from 20° F. to 50° F. This gives slow registration and ample time for reading. Care should also be taken to keep these thermometers, when not in use, in a place at a temperature which will not affect them. Thermometers should be placed in the positions where the extremes of temperature may be looked for, *viz.*, near the overheading and low down in the compartments. There should be also a sufficiency of locations for them in proportion to the size of the compartments, and the engineers should realize the importance of absolute precision in the records they make, not only of the temperatures maintained at each station of the refrigerated spaces, but also of the brine flow and return of each circuit and the sea water and atmospheric temperatures, such records of actual water data being extremely valuable in locating faults and also in furnishing information for guidance in future installations.

On this point it will be well to quote Mr. F. W. J. Moore in a paper on "Fruit in Cold-Storage," read at the Congres du Froid. He says: "Self-registering thermometers in ships' holds would not only be a check upon carelessness and neglect, but if the figures were available to all who take an interest in them the results of comparisons would be of great assistance." He also quotes from a report made by the Hon. W. Fawcett to the Governor of Jamaica upon the carriage of fruit: "I consider it important for a thorough investigation of the subject to have daily records of temperature and humidity in the holds and insulated chambers all through the year, and also a report on the condition of the fruit in each place as it is taken out at the port of arrival."

It should, of course, be mentioned that frequently self-recording thermometric instruments are fixed in the hold in duplicate, in places where they cannot be tampered with during the voyage. One instrument is controlled by the shippers and the other by the shipowners, who compare the records made. It must be said, however, that absolute confidence is not felt by all engineers in these records. It is said that the vibration of the ship affects the instrument making a wavy line where a straight line would be drawn by the same instrument if fixed on shore, also that the record shows a step which would be thought to indicate a change of temperature every time the vessel is struck by a heavy sea. In other words, the instrument is both too delicate for use on shipboard and not sufficiently sensitive for use where changes of temperature of a fraction of a degree are desired to be recorded.

Another matter of much importance which ought not to be lost sight of is the question of dryness or humidity of the air in the chambers. A dry atmosphere is of undoubted advantage in the prevention of bacterial growth on the meat. With the brine pipe system of cooling the chambers in which chilled beef is carried on shipboard there is, however, unfortunately, practically no control with regard to the humidity of the air, assuming that the insulation is thoroughly efficient as these chambers are sealed and inaccessible after loading.

Hydrometers, etc., are largely used in cold storage on shore where the attendant has access to the instruments, but when used on board ship, even if special tubes were fitted through the decks to the chambers to enable them to be lifted for examination, the results would be very unreliable owing to the very sensitive nature of these instruments.

A certain amount of moisture coming partly from the atmosphere when the holds are first cooled down, and to some extent from the desiccation of the cargo, is deposited on the brine pipes with chilled beef cargoes, and as the temperature is below 32° F., these deposits take the form of frost and remain on the pipes.

After the discharge of the cargo this has to be thawed off, and special care has to be taken that the resulting water does not injure the insulation.

In cases where the hold temperature has to be maintained above the freezing point, say when carrying fruit, it is usual to employ only part of the grids for cooling, so that the brine in them can be kept below 32° F. The deposition of moisture on them will then be in the form of frost. If more grids are employed and the brine consequently used above 32° F., the moisture would be deposited as dew, and trouble both with the cargo and the insulation would result from drip. Even when only sufficient cooling surface is employed to enable it to be kept below 32° F., it has been found that the fastenings of the grids have become warmer than 32° F., dew has deposited on them, and trouble has arisen from the drippings from these fastenings.

Prior to loading and after discharging the cargo and thawing off the brine pipes, suitable means of ventilating the meat chambers by forced circulation should be provided, so that foul or stale air can be abstracted and replaced with fresh air. It is hoped that a more thorough appreciation of the importance of ventilation of meat chambers will be given in the future; and that no trouble will be spared in carrying this out, as it is especially important, not only for the purification of the chambers, but as also tending to the preservation of the insulation and helping to retard dry rot in the wood.

I have endeavoured in this paper to touch upon what I have considered to be the main points which should be taken into account in dealing with the carriage of produce within small limits of temperature. I feel sure that the subject is one which will appeal with special interest to many here, and it is hoped that the discussion, which is to follow, will be of service in determining the best methods to be adopted to ensure the greatest success, and so lead towards the evolution of the perfect system.

Brussels International and Universal Exhibition.—May to October, 1910.—The Royal Commission appointed to take charge of the Exhibitions at Brussels in 1910, and at Rome and Turin in 1911, has studied exhaustive reports of executive work in other countries, and has also been at great pains in investigating the methods pursued at previous exhibitions in which Great Britain participated. The Commission, which is presided over by H.R.H. the Prince of Wales, has its offices in Queen Anne's Chambers, Westminster, and the active official is Mr. U. F. Wintour, Secretary and Commissioner-General and Director of the Exhibitions Branch of the Board of Trade. This branch is to be a permanent office for the consideration of future and revision of past international exhibitions in which Great Britain has been, or will be, concerned, and all conceivable information required by proposed exhibitors can now be promptly given. At Brussels next year the British Government has secured perhaps the most prominent position in all the Exhibition for its section. The British section amounts to 203,140 square feet, of which 150,640 square feet are in the Industrial Hall and 52,500 square feet in the Machinery Hall. One great advantage being that visitors must pass through the British Galleries before reaching the French, German, Italian, American and other national sections, and the old proverb of "first impressions" holds good. The main gallery running through the British section is 510 feet long by 98 feet wide, and there are four other parallel galleries 50 feet wide, which lend themselves to the formation of attractive courts for the display of the different classes of manufactures. In the Machinery Hall the portion allotted to Great Britain occupies the centre of the hall, and has easy access to the electric, steam, water and gas mains, from which power can be obtained for showing all classes of machinery in motion. It is also intersected by three lines of rails which communicate directly with the Belgian State Railway system. There will be no isolation of British exhibits; all will be shown together appropriately grouped and arranged under the immediate supervision of officials of the Royal Commission. All the exhibitor has to do is to purchase the space he requires and see to the transportation, for which a variety of special facilities have been secured. The principal railway companies, for instance, have agreed to accord a reduction of 50 per cent. on the usual rates for the conveyance of all unsold exhibits returned after the close of the Exhibition. The Royal Commission officials will undertake the entire handling of the exhibitor's goods within the Exhibition; not only unloading and displaying on the space reserved, but storing all empty cases packing and reloading at close of Exhibition. With the exception of machinery and rolling stock, the exhibits of Great Britain will be grouped so as to form a complete national display of the various manufactures and products; and with a view to uniformity, the Royal Commission will undertake the entire decoration of the British section and provide all show cases, stands, platforms and screens required by each individual exhibitor without further

charge. In order to assist in attaining this desired and most necessary improvement of uniformity, the scheme of decoration and grouping will be carefully explained to intending exhibitors, and every endeavour made to reconcile conflicting interests. If an exhibitor prefers to use his own show cases, no objection will be made, provided such show cases are sympathetic to the general scheme of decoration and surroundings. Designs of show cases and the proposed decorations will be on view at the offices of the Exhibitions Branch of the Board of Trade at an early date. The Commission will defray fifty per cent. of the charges made by the Belgian Administration for the supply of steam, gas, and electricity, when used for showing machinery producing finished articles, or illustrating a process of manufacture. This should be a most welcome reduction of expense, judging by the complaints of costs made by machinery exhibitors at previous World's Fairs. Exhibitors requiring foundations or shafting for machinery must provide them at their own cost, but can, upon sending to the offices of the Royal Commission drawings with metric measurements, have estimates obtained for them from Belgian contractors, and the work carried out under the superintendence of a competent engineer employed by the Royal Commission. No charge will be made to exhibitors for assistance rendered in this connecton. Estimates from a reliable contractor in Brussels, under the supervision of the Royal Commission, will be supplied on written request to the General Commissioner at Queen Anne's Chambers, and other estimates from equally reliable sources in Belgium can also be obtained. Crane power will be provided up to seven tons weight free of charge, and special facilities for handling heavier weights can also be secured if application be made. A special catalogue of the British section will be made in English and French without charge to the exhibitor, either for translation or insertion, and all necessary steps will be taken by the Belgian Government for the protection in Belgium of inventions, industrial designs and trade marks shown at the Exhibition. In regard to the question of dual language, the Royal Commission specially wishes to impress upon exhibitors the desirability of having their trade catalogues and price lists translated into French. Metric equivalents of the dimensions and weights of exhibits may often be given with advantage where such information is required, and the exhibitor's agent should be in a position to quote the purchase price in Belgian currency, inclusive of freight, custom duties, and other charges. The Customs Tariffs of the principal European countries will be filed in the exhibitors' reading-room, together with the British Commercial Directories, a collection of technical dictionaries and telegraph codes. The Royal Commission will provide a special apartment in which exhibitors or their agents may conduct business and deal with their correspondence. A staff of interpreters, acquainted with French, German and Italian, will also be available to afford any assistance and information that may be required.

The Bow Foundry.—Bromley is one of the most eastern parishes of London, situated on the banks of the river Lea or Bow Creek and bounded by the great main road stretching from Bow Bridge up through Mile End and Aldgate to Cornhill. An ancient church in the parish, dating back to about 950, is said to have been founded by Dunstan. Soon after the Norman Conquest a great priory was built and put in charge of an abbess. The church has been partly rebuilt at various times, but some of the original portions still remain. The old village remained a quiet country spot until about 100 years ago. The utilisation of the Lea for inland navigation led to several small industries being started on the banks. The East India docks were excavated in the southern part of the parish in 1803-6. Around the old church and villas several factories were founded and still flourish. Among these what is known as Edie's foundry was started in a small way in a back yard ; it now covers nearly an acre of ground, having grown with the district, obtaining its customers from the works and factories around. Going further afield the proprietors began to cater for the steamers using the adjacent docks, and as confidence was gained, extending the area of their customers to the Victoria docks—excavated in 1854—and the Royal Albert docks—1870. There are many other factories that can trace their history back to the last century, such as Smith, Garrett's Brewery and Berger's Starch Works. In 1801 the population of the parish appears to have been under 1700, with a poor rate of 6d. per pound ; now the population is about 70,000, with a poor rate of 5/- per pound, and with greatly increased assessments. The surroundings are such at the present day that it is difficult to realize that some fifty years ago corn grew in the parish. In the course of our wanderings lately we paid a visit to Edie's foundry and found traces of the old world within its gates, relics of the past mingled with modern ideas to meet the requirements of the present, from the stock of standard cast-iron fittings, ready to meet immediate demands from wholesale or retail merchants or works. Cast-iron pipes and sockets, pillars and stands, propeller blades and fire bars, plain or patent, were all represented amid the patterns and castings. Evidently the moulders were kept busily employed, as at the time of our visit the floor space was well covered with boxes, awaiting the molten metal to convert the mould into solid matter. The casting of fire bars appeared to be made a specialty of and this class of work may be said to be similar to pin making—it pays if there be plenty of it, and from the appearance of things the orders were fairly numerous for the classes of bar represented by the common and by the more refined patent bar. The names of steamers on the pattern bars we saw around were familiar in the London docks. A runway is being erected to facilitate despatch and reduce labour between the cupola and the moulding shops—two elements in economic work which require more and more attention in the close competition of to-day.

Huhn Packing.—We have before us a sample of Huhn packing of Messrs. Snowdon, Sons & Co., Ltd., of Millwall, which consists of square sectioned hollow white metal rings. It is in a half-circle, two being brought together to embrace any rod from ¼-inch in diameter to any higher diameter. These rings are filled with lubricant with the ends sealed up, so that the lubricant can only issue through the small holes which are drilled inside on the working surface. The packing is self-lubricating as well as being metallic. We are not, therefore, surprised to hear that it is in use in, at least, ten navies, including the British, French, United States, German, Russian, Italian and Spanish. Beyond this it is in use in the North German Lloyd, Austrian Lloyd and other ship-owning firms in whose hands it is highly thought of. It is also used in a large number of works, mills and mines. These white metal rings are made so as to stand a steam temperature of 650 deg. F., so that even high pressures of super-heated steam are provided for. If the super-heat should be excessively high, soft copper is used, instead of the white metal and they are made in exactly the same way. It is claimed for Huhn packing that it will not score rods or plungers and is perfectly tight and practically frictionless. It must be remembered that this packing has no complicated parts to break or to get out of order, and only needs replacement at long intervals, say, from three to five years.

Sinol Lubricant.—The lubricant Sinol which is introduced by Snowdon, Sons & Co., Ltd., is not oily in its constitution and does not therefore pass through the cylinder to the boiler. It retains its lubricating qualities for super-heated steam up to such temperatures at which the best cylinder oil is of no use, and enables the condensed steam to be again used in the boilers as the water is found entirely free from oil or grease. This may enable filters and separators of the oil from the water to be entirely dispensed with. It is said that Sinol is a new departure and by far the best cylinder lubricant for petrol oil and similar engines, and a user says that one pound of Sinol is equal in efficiency to two or more gallons of cylinder oil. It is said also by those who know that the use of Sinol reduces the friction as much as 8 per cent., and that the surface of the cylinder and piston after many months' use has been found excellent, and shows no signs of wear.

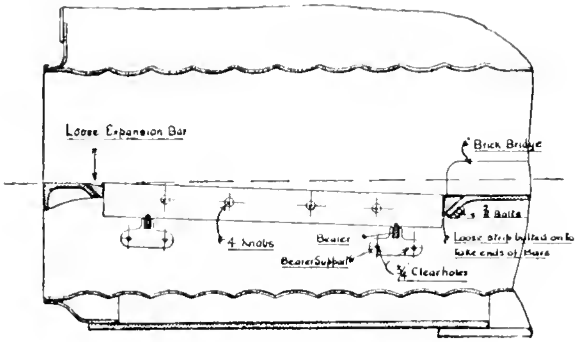
Messrs. John I. Thornycroft & Co., Ltd.—Concentration of works at Basingstoke and Southampton. Messrs. Thornycroft & Co., Ltd., write us that having disposed of their Chiswick works, their head office has been transferred to Caxton House, Westminster, S.W. The marine motor, stationary motor and motor launch sales department will also be situated at Caxton House. Large and well-equipped garage and repairing works have been acquired at the Vauxhall Bridge Garage, 5/11, Vauxhall Bridge Road, S.W.

FIRE BARS AND BEARERS.

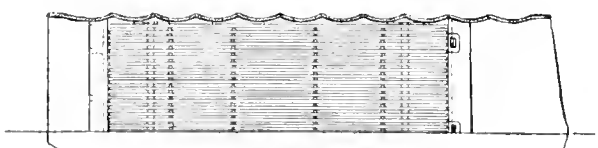
We have had brought to our notice a simple form of fire bar for application to marine, land or locomotive boilers, which is the invention of Mr. R. G. Hunter, a chief engineer in the Royal Mail Steam Packet Co.

The illustrations show an elevation, plan and section, the latter to a larger scale, of the bars in position in a corrugated furnace of a marine boiler. The chief features of the bars are their depth, thinness, regular spacing and the unobstructed air space which they allow.

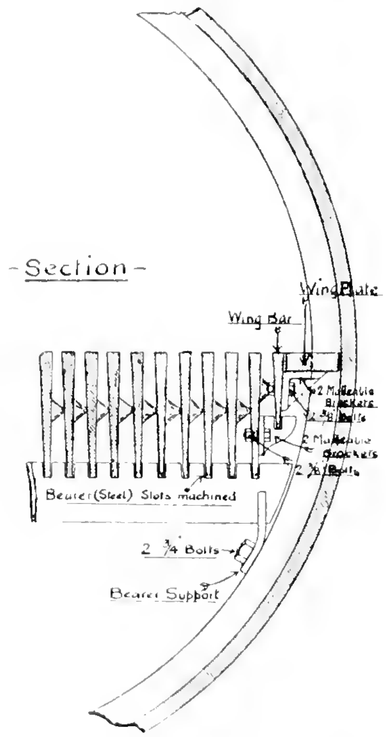
Each bar has four cones or knobs cast on one side, the other side being quite plain. The knobs, together with the special machined bearers, maintain a definite air space between the bars throughout their entire length. This unobstructed air space is a special feature of the grate.



Longitudinal Sectional Elevation



—PLAN—



condition of affairs is quite impossible, thus a frequent source of trouble is entirely eliminated.

The ends of the bars are at right angles to their length and abut against angle plates. The back angle plate is securely bolted to the bridge plate casting to form a square end for the bar. The front angle or expansion bar rests on the apron plate, and is quite free to slide on it, as the bars expand and contract.

The bars are made of a special mixture of metal and are machine moulded, thus ensuring uniformity in both composition and section. The large air space and the great depth of the bar conduce to keep them cool, and consequently the bars have a much longer life than the ordinary form of bar. The bearer supporting brackets are thin steel plates slotted for the bearers and secured with two studs to the furnace sides.

The special form of the bars, together with the greatly increased area for the admission of air, as compared with other bars, not only keeps them comparatively cool, but affords a means for heating the incoming air before it enters the fuel, thus adding materially to effective combustion and greatly reducing the density of the smoke. This advantage will particularly appeal to owners of land boilers situated in thickly populated areas.

The two side bars have malleable iron brackets bolted to them for supporting the wing bars, and the latter in turn support the wing plates, which fit the corrugations. (See section.)

The bars are supported in special steel bearers, which are accurately slotted in the machine to take them, thus making it impossible to place more bars in the furnace than the bearer slots will admit. These slots have sufficient depth to prevent the bars falling over under any conditions.

With the ordinary bars it often happens that the space for the last bar is restricted, and the bar is tightly wedged into position, with the result that when they expand they exert a considerable thrust on the sides of the furnace, thus setting up severe stresses tending to distort the furnace and bring down the crowns. With the patent bars and bearers this

The bars are made in standard lengths of 4′ 0″, 4′ 6″, 5′ 0″ and 5′ 6″, the latter length being the maximum, as it is generally acknowledged that fire grates exceeding this length cannot be efficiently stoked. The bars are stocked in above standard lengths for both natural and forced draught boilers, and thus afford a splendid opportunity for steamship companies and others to standardize their fire bars.

The bars were fitted about fifteen months ago to a steamer engaged in the Continental trade, and owned

by one of the leading British steamship companies. Trials were very carefully conducted over a period of six months. During the first three months north-country coal only was burned, and during the latter three months mixed Welsh coal.

The results in each case were highly satisfactory, and showed a marked decrease in consumption, amounting to not less than 5 per cent., whilst at the same time the previous speed was considerably exceeded. The comparisons were made with the results of previous runs at the corresponding season of the year. With a view of further testing the bars the same company have had one boiler in one of their latest mail steamers fitted with the bars, and the vessel has now completed two trips to Brazil and River Plate ports, and the reports from the chief engineer are highly satisfactory.

Messrs. Allen & Co., 112, Arundel Street, Sheffield, are the sole licensees and manufacturers for the United Kingdom and Belgium, and they have concluded an agreement with Messrs. Silley, Weir and Co., Ld., engineers, etc., 155, Fenchurch Street, under which the latter firm will quote for supplying and fitting bars and bearers complete to proposed or existing boilers.

North-East Coast Institution of Engineers and Shipbuilders and The Institution of Engineers and Shipbuilders in Scotland.—The detailed official programme of the Joint Summer Meeting of the Institution of Engineers and Shipbuilders in Scotland and the North-East Coast Institution of Engineers and Shipbuilders, to be held in Glasgow on the 4th, 5th and 6th August, has now been issued to those who have signified their intention of taking part. It is computed that about 200 members will be present from the North-East Coast and that some 600 members of the Scottish Institution will take part. The following papers will be read and discussed: "Sixty years of merchant shipbuilding on the north-east coast," by Dr. G. B. Hunter and Mr. E. W. DeRusett, M.I.N.A.; "Fifty years of warship building on the Clyde," by Prof. J. H. Biles, LL.D.; "Notes on the trials and performances of the s.s. *Otaki*, fitted with a combination of reciprocating and turbine machinery," by Eng. Com. W. McK. Wisnom, R.N.; "A slight sketch on the hisrory of propellants," by Sir Andrew Noble, Bart., K.C.B., F.R.S., D. Sc.

Messrs. Leonard Chapman & Co., Munton Road, London, S.E., report:—Graphite as imported, according to quality:—

Ceylon L.L. c.i.f. London	£32	0	0 to £53	0	0	per ton
,, O.L. ,,	17	0	0 to 18	0	0	,,
,, chips ,,	15	0	0 to 35	0	0	,,
,, dust ,,	9	0	0 to 20	0	0	,,
Purified milled and ground Ceylon, 97% to 99% f.o.b. London	66	0	0 to 68	0	0	per ton
,, 90% to 91% ,,	42	0	0 to 45	0	0	,,
,, 85% to 86% ,,	40	0	0 to 42	0	0	,,
,, 70% to 71% ,,	28	0	0 to 30	0	0	,,
American large flake f.o.b. London	45	0	0 to 49	0	0	,,
,, small ,,	35	0	0 to 45	0	0	,,
Graphite Joint Compd. ,,	2	5	0 to 2	7	6	per cwt
Graphite Paint Paste ,,	2	2	0 to 2	3	0	,,
Graphite Paint ,,	0	4	6 to 0	5	0	per gal.

The Newall Engineering Co. The removal of the works and offices to Blackhorse Lane, Walthamstow, is now completed, and the new factory fully equipped and running. All arrangements have been satisfactorily made for continuing, upon improved lines the production of those articles associated with the Newall name and of such additions to standard products as may from time to time be found requisite for satisfying the needs of engineering firms, whose attention is now being more closely given to the questions of gauge and tool-room equipments.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

Old Steamers.

Whilst new tonnage is being added to the fleet of the International Mercantile Marine Company at the top, in the shape of the *Megantics* and *Laplands* and *Minnewaskas* there is a constant removal of obsolete tonnage from the bottom. The last to go has been the *Texan*, built in 1883 at Belfast by Messrs. Harland and Wolff for the old West India and Pacific Steamship Co. She is of 3258 tons gross register and has compound engines. When the old company for which she was built was absorbed, she was taken over with the rest of the fleet by the Leyland line and they have now parted with her for some £6500 to a firm of shipbreakers at Genoa.

The Austrian Lloyd Company

seems to be as anxious to increase its tonnage as its Government is to add "Dreadnoughts" to the fleet. Some eight vessels are now under construction to supplement the steamers engaged in various Mediterranen trades, although both in passengers and weight of goods carried the year 1908 compared unfavourably with its predecessors, there being a decrease of about 64,000 in the numbers of passengers and of 87,000 tons in the weight of the goods traffic. This, of course, is pretty much the story which other big lines had to tell in respect of last year, and no doubt the trouble in their case was somewhat accentuated by the Turkish boycott. But whilst there was retrogression in certain directions there was much encouragement in others. In spite of bad business generally, and a scarcity of money in British India, there is reported to have been a steady increase in the trade both outwards and homewards. The services of the company are now being extended so as to include the ports of Saigon and of Siam. It is interesting to see that the Lloyd now experience a difficulty in combining the business of shipbuilding with that of shipowning, and accordingly it is suggested that the well-known arsenal at Trieste, where so many vessels have been built for their fleet, be disposed of. This is especially interesting in view of the experience of the Compagnie Générale Transatlantique. It may be remembered that the great French company experienced much the same difficulty and that it resulted some few years ago in their disposing of their yard to a separate organization.

The New Cunarders.

The *Mauretania* continues to do excellently and to improve time after time on her own records. The *Lusitania* also does well, but has not yet attained the speed of her later sister. Accordingly it is the intention of the Cunard Company, after the next round trip of this vessel, to dry dock her at Liverpool and to fit her with new propellors of the type which has proved so successful with the *Mauretania*, and we may, therefore, soon look to seeing her too showing an enhanced speed and rivalling the records of her companion.

The White Star Line

seems to be quite satisfied with its experimental call at Holyhead on the westward trips of its Liverpool passenger steamers. A weekly call is now made at the Welsh port by the inward vessels, and on Saturday, the 10th July, the *Arabic*, outward bound to New York, picked up a large contingent of London passengers in Holyhead harbour. The special train had left Euston at 12.30 p.m. some two and a half hours later than the usual boat train *via* Liverpool. The tender *Magnetic* was sent round from Liverpool to transfer the passengers to the *Arabic*, whilst the London and North-Western steamer *Edith* was employed to deal with the baggage and the whole operation was expeditiously carried out. This arrangement is to be continued, at least for the present.

The Isle of Man Steamship.

Ben My Chree has been breaking records in July. She steamed from Liverpool to Douglas in two hours and forty eight minutes on the 6th July. Two days later she took a party of shareholders on a trip to Dunoon from the Isle of Man, doing the passage of 140 miles in about five hours and

a half against a heavy head wind and sea. She was, of course, an exceptionally large steamer to visit the little Scotch port, and her arrival was somewhat of an event. On the Douglas trip she averaged 25 knots although she had to slow down for the first fourteen miles of the run to comply with the requirements of the Mersey Docks and Harbour Board. This vessel is the largest turbine steamer engaged in the coasting trade, and the development of this class of steamer is emphasized by the comparison between her and the famous Atlantic greyhound *Arizona* of thirty years ago, the *Ben My Chree* being no less than four feet greater in beam and some eleven knots faster than the ship which created so great a record on the Atlantic in her day.

The "Slavonia."

There is not only now no hope of salving this fine steamship —it was seen to be an impossible task from the first—but there seems to be little chance of getting up any more cargo. Some 2282 ingots of copper have been raised from the after holds by the divers of the Liverpool Salvage Association, but they have had to abandon for the time further attempts even at this end of the wreck. The strength of the currents round the fore part of the ship made it impossible to attempt work at these holds.

Early Steam Navigation.

On the 10th July a launch of unusual interest was effected, though the craft put into the water on the occasion was scarcely larger than a canal barge—being but 159 ft. long. The interest lay in the fact that she is to be an exact replica of the famous steamer *Clermont*, which was the first vessel to navigate the river Hudson under steam. Every detail of the original craft is being carefully reproduced, and historical accuracy is being studied by those connected with her, as is evidenced by the fact that the flag which flew at her bow had sixteen stars emblazoned upon it to mark the circumstance that when Fulton realized his design of building a steamer the American Union comprised but sixteen States. Like her great prototype the new *Clermont* is to steam up the Hudson to Albany, being intended to take part in the autumn of the present year in the centenary of the inventor at the capital of the State of New York. With Fulton will be honoured on this occasion the famous Dutch explorer Henrich Hudson, after whom the great river takes its name. He, too, will be commemorated by a full-size model of the old ship in which he sailed up the river. Her name was the *Half Moon*, and though probably a much more unaccustomed sight to modern eyes even than the *Clermont*, her name is much the less familiar of the two to the man in the street. The new *Half Moon* was constructed in Holland and not in the United States. She is now on her way across the Atlantic but is being carried by a cargo steamer and is not braving the risks of an ocean voyage. The *Clermont*—a paddle steamer without paddle boxes—with copper boiler and with all machinery exposed to the weather, will be a sufficiently curious object to those who encounter her on her trip or who inspect her during the time she will be on view.

British Ship-owners and their Claims against the Russian Government.

In the House of Commons the other evening Mr. Beauchamp raised the question of the claims of the owners of the cotton cargo of the British steamship *St. Kilda*, seized by the Russian Government steamship *Dneiper* on the 23rd May, 1905, during the course of the hostilities between that country and the Japanese. The Russian Prize Courts held that the cotton was absolute contraband of war, whilst our government has always considered that cotton is at most only conditional contraband. Representations have been made by our Foreign Office to the Russian Government requesting compensation for the loss of this cargo, but the request has always been refused, suggestions that the question might be referred to arbitrators being also declined. Mr. Beauchamp urged the Government to use more strenuous efforts to obtain the Russians' consent to arbitration. But—and this is the interesting point of the incident—Sir Edward Grey explained that he could not insist too strenuously on arbitration in this matter, because in similar cases which arose between ourselves and foreign governments out of similar instances when we were carrying on the campaign in South Africa we had always refused to admit that arbitration was in such cases possible.

A Collision.

The New Zealand Shipping Company's steamship *Whakatane* had a narrow escape from total loss on the morning of the 4th July, when she was run into off Dungeness by the French steamship *Circe* of Caen. The *Whakatane*, which was outward bound from the Thames at the time, was struck in the engine-room on the starboard side, and for a time seemed in danger of sinking. But being taken hold of by some five tugs she was eventually beached in Dover Harbour, whence, after temporary repairs, she was safely conveyed to the Thames and docked. The *Whakatane*, which was built in 1900, is of just under 6000 tons gross. The casualty which has befallen her is very similar to that which happened not so very long ago to the same company's twin-screw steamer *Tongariro*.

The Zeeland Steamship Company

has now launched the second of the three twin-screw liners which it is having built at the Fairfield yard for its service between Queenborough and Flushing. This vessel, which is of about 3000 tons gross register, will carry some 246 passengers in the saloon and no less than sixty of these will be berthed in single cabins. Her name is *Oranje Nassau*, and she is a sister to the *Princezzin Juliette*, recently launched for the company from the same yard.

The United States Congress

is considering a new Ship Subsidies Bill. The scheme put forward would levy a tonnage tax of two cents a ton on entry of vessels from oversea into American ports. But the greater part of the tax would be returned to United States owned vessels if they carried American citizens as apprentices to the sea. The bill also purports to revise the law regulating the registration of foreign-built vessels in the United States.

The Report of the International Mercantile Marine Company.

Mr. Morgan's company has now issued its report for the year 1908. It is not cheerful reading. From upwards of $7\frac{1}{2}$ millions sterling gross voyage earnings have fallen to just under six millions, whilst miscellaneous earnings are barely half what they were a year ago. Expenses have, however, been considerably reduced. But the final balance sheet nett earnings have fallen from nearly one and a half millions to about £180,000. As fixed charges and taxes amount to £740,000, there is a deficit of £340,000, after allowing for the money made on the insurance account. The fleet has been reduced by the sale of three steamships, the Red Star Liner *Noordland*, the Atlantic Transport Co.'s steamship *Menphis* and the Leyland liner *Floridian*. There have, however, been added to the fleet several notable vessels, such as the *Megantic* and *Laurentic*, the *Minnewaska* and the *Lapland*.

The "Orvieto,"

the last of the five new steamers of the Orient Line fleet, has been successfully launched by the firm of Messrs. Workman, Clark & Co., of Belfast, who have already launched one new vessel for the service, *viz.*, the *Otranto*.

Ships' Names.

The collision between H.M. second-class cruiser *Sappho* and the Wilson liner of the same name was remarkable for several matters. In the first place it must be remembered that the crew of the warship was largely composed of reserve men, and it is highly creditable to them that under such highly trying circumstances as those in which they were placed —in darkness and fog on an apparently doomed vessel, they showed the steadiness and discipline which is traditional with British seamen. Then came the highly creditable performance of the repairs to the damaged warship, whereby she was so quickly restored to efficiency and the fleet. But the point to be especially remarked on in this column is the extraordinary co-incidence that two vessels of the same name—and that not one of the most common—should have succeeded in running into each other. The incident is, I should fancy, quite unprecedented and it is a curious commentary on the provision of the Merchant Shipping Act of 1906 which regulates the registration of the names of merchant ships.

Under that statute the Registrar-General of shipping has power to refuse to allow the registration of a name for a merchant vessel, if he thinks it probable that the doing so will be likely to cause confusion with some other merchant vessel already bearing that name or one very like it. Though I believe the action taken under this enactment has on more than one occasion caused some dissatisfaction on the part of those who tendered certain names for registration, it would seem that even the new practice does not preclude the possibility of error. A name given to an Atlantic liner may still be taken by an East Coast collier, a tramp or a steam trawler, whilst there is certainly no practice and no legal right to object to the use of a preferred name because it is already held by a king's ship. But the chances of a repetition of the *Sappho* incident are really so remote that it does not seem worth while to take legislative action to anticipate the occurrence.

THE "SELSON" SHAPING MACHINE.

An exceptionally powerful shaper, capable of taking the heaviest cuts at high-cutting speeds, is illustrated in the adjoining diagram.

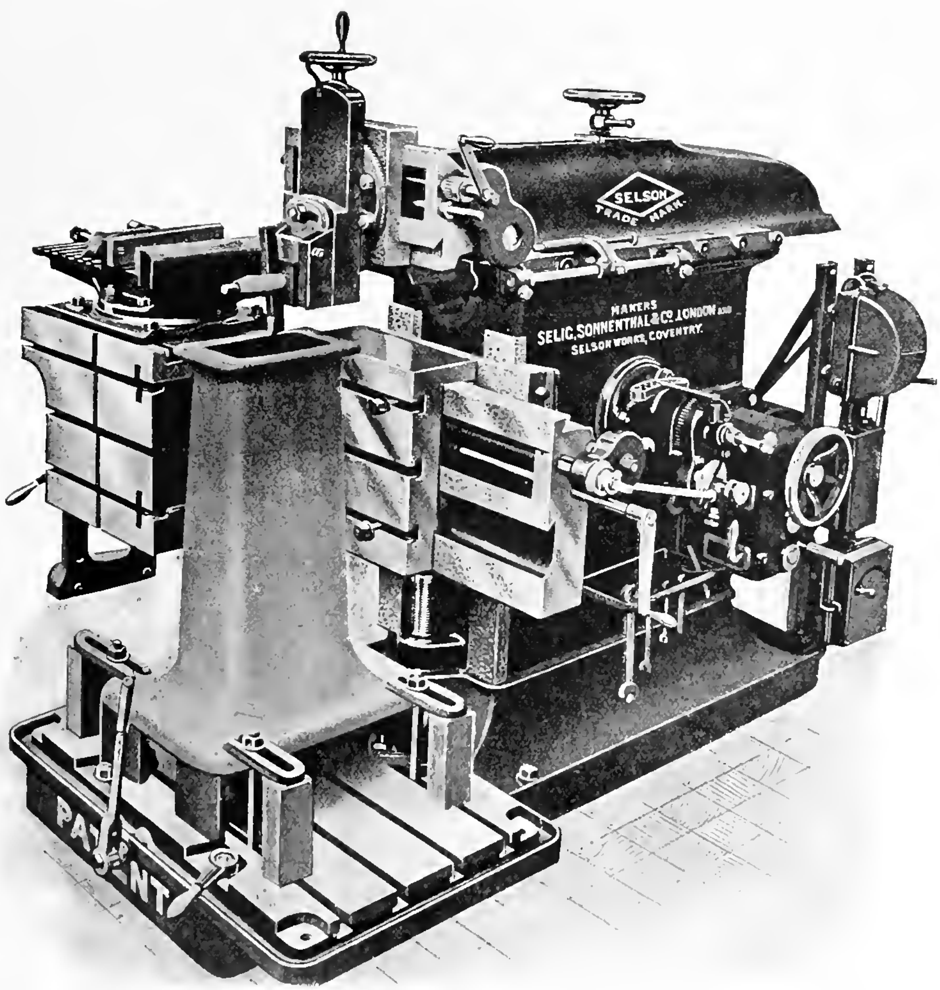
This machine has been especially designed for operating on articles too large to be mounted on the ordinary rising and falling table, and for this purpose the base plate is provided with a table which carries the work and can be traversed laterally, either by hand for adjusting purposes or, if so desired, automatically.

The head of the ram is built in the form of a cross slide, along which the tool slide is adapted to traverse automatically.

It will be recognised that by combining the lateral movements of the bottom table and tool slide, work which is usually done on a planer—such, for example, as machining the main bearings of small engine beds, etc.—can be performed on this machine. To do this the work is bolted to the bottom table, which is locked to the base plate, and the first bearing is machined with the travelling tool.

The table is then adjusted until the second bearing is brought to the position originally occupied by the first, and the machining process is repeated. A good example of the work thus carried out is given in the illustration, which shows a column being faced.

In order that a clear space is available for large work, the ordinary rising and falling table is hinged to the cross slide, so that the table can be swung round on its hinge from the front to the side of the machine.



This machine, which is of an exceptionally substantial character, is manufactured by Messrs. Selig, Sonnenthal & Co., of London and Coventry.

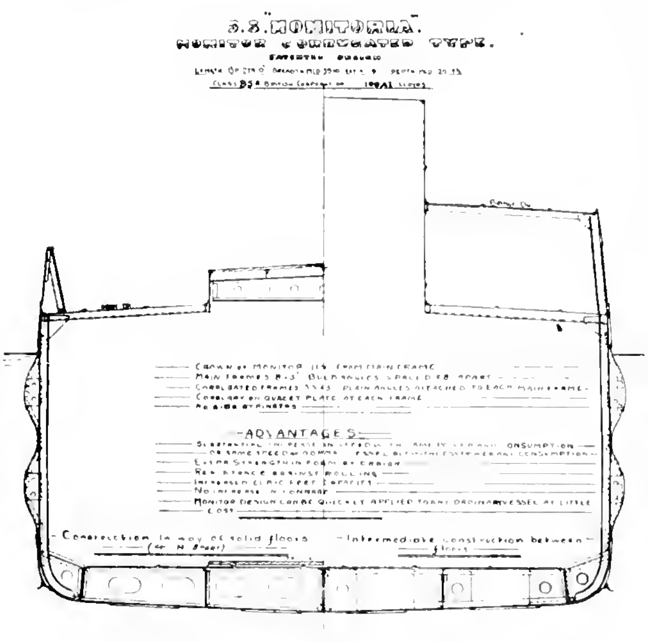
THE "MONITORIA."

A New Type of Ship.

THE launch of the *Monitoria*, constructed by Messrs. Osbourne, Graham & Co., of Hylton, for the Ericsson Shipping Co., Ltd., Newcastle, took place on July 5th.

The vessel has a new feature in that there are wave-like projections along each side, the object of which is to give increased speed with the same amount of power and consumption of fuel, or the same speed as in the ordinary type of vessel with less power and consumption of fuel, extra strength in form of design, better resistance against rolling, and increased cubic-foot capacity without increased tonnage. Another advantage claimed is that the invention can be applied to any ordinary vessel.

The dimensions of the vessel are 279 ft. between perpendiculars, 41 ft. 9 ins. extreme breadth, 20 ft. 7½ ins. moulded depth. The type is a single deck with poop, bridge and forecastle. The vessel is to be engined by the North-Eastern Marine Engineering



Co., and is intended for a general cargo. Her deadweight capacity is about 3,300 tons. She has large hatchways, five winches, steam windlass, steam-steering gear and large water-ballast capacity. She will have triple-expansion engines with cylinders 21 ins. and 56 ins., with 36-inch stroke; two boilers 180lb. pressure and donkey boiler.

Following the launch the guests, numbering about 200, were provided with light refreshments in a marquee erected in the yard of the builders of the vessel, Messrs. Osbourne, Graham & Co., and a short toast list was gone through. Mr. T. H. Patterson (of Messrs. Osbourne, Graham & Co.) presided.

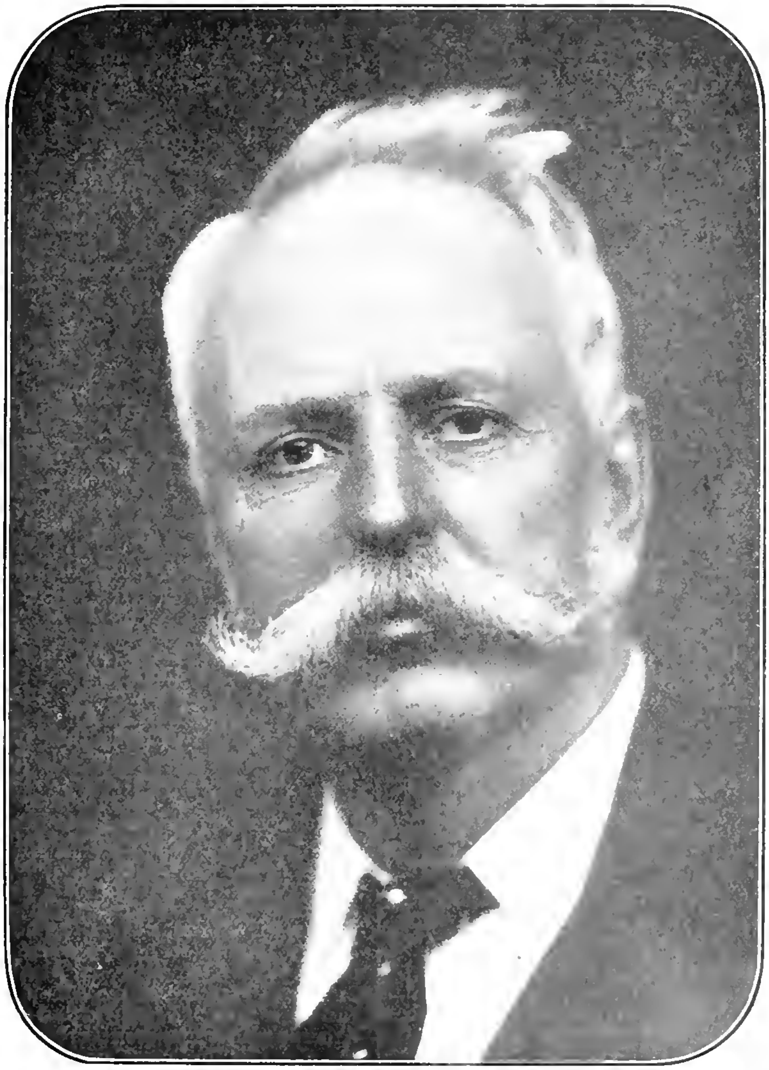
The Chairman first proposed "The King," and this toast having been loyally honoured, he submitted "Success to the steamer *Monitoria*." He said the *Monitoria* was the first vessel of its kind, and was built in direct contradiction to all the rules of naval architecture. The design belonged to the Monitor Shipping Association, and was made by Mr. A. H. Haver, and he thought a ship like the *Monitoria*, that would carry a greater deadweight and go at increased speed without any increased consumption of fuel when compared with an ordinary vessel, was one that must be very desirable to all owners. He referred in detail to the advantages of the *Monitoria's* design, and said 100 tons deadweight was through this added to her carrying capacity without increasing her tonnage. The method of construction was nine times stronger than in the case of ordinary flatsided vessels, and that would certainly make her less liable to damage. An advantage of the design was that it could be applied to vessels now constructed, so that ships running at present at a loss could be made into Monitor vessels and made profit-making concerns even at to-day's freights. (Laughter.) If the success attending the *Monitoria* was anything like the results of the trials with the models, Mr. Haver would go to the top of the tree in naval architecture. (Applause.)

Mr. Ericsson, in responding to the toast, said the name "Monitor" was after the steamer *Monitor*, built by the well-known Swedish-American engineer John Ericsson, that in 1862 defeated the *Merrimac*, for which every American to this day was grateful. The new principle would, he thought, be of great value to the British Government if applied to warships, and would lead the way to a new school of naval architecture. (Applause.)

Mr. Haver also responded as the designer. He said when the "Monitor" design was first suggested to him he, in common with most naval architects, was not particularly taken with it. It meant more wetted area, and, like others, he believed that more wetted area involved more horse-power. Therefore he commenced the trials with an adverse opinion of the idea. The trials with models were made in the experimental tank of Mr. Frank Caws, and at first that gentleman was in the same frame of mind as himself respecting the idea. They started the trials, however, and the first showed a saving of 8 per cent. horse-power, and before he died Mr. Caws was convinced that the idea would have a far-reaching improvement in the construction of ships. He (Mr. Haver) continued the experiments, and in a few months came to the conclusion that there was really a vast improvement that ordinary laws did not account for, and had to admit that the wetted-area law required a little qualification. Having dealt with the advantages of the "Monitor" design in respect to carrying capacity and strength, Mr. Haver said the projections were not made by guess-work, but particularly shaped to suit the proportions and contour of the ship. Speaking of the speed-increasing power they gave, he explained that they added to the buoyancy of the ship and had a steadying effect on the waves and stream-lines. He conceived that these stream-lines and waves had the same effect as a bumpy road had upon a road vehicle; in proportion to the magnitude of the waves or road inequalities, so in both cases would their horizontal speed be reduced by the power consumed in the vertical lifting and falling. By saving the power expended vertically and applying it horizontally he believed the "Monitor" design got a greater speed with the same original power. (Applause.)

RETIREMENT OF MR. H. J. CORNISH.

AFTER a long and honourable connection, extending over forty-six years, with Lloyd's Register of Shipping, Mr. Harry J. Cornish, Chief Ship Surveyor to that Society, is about to retire from his important position. During this prolonged period Mr. Cornish has rendered much valuable service both to the Society and, through it, to the shipping community at large. He comes from a seafaring stock, for his grandfather fought on Nelson's ship at the Battle of the Nile. Born at Devonport in 1839, Mr. Cornish was privately educated and afterwards gained valuable experience of a Ship Surveyor's duties in Deptford Green Dockyard, where he continued until 1863, when he was Benjamin Martell, and after serving thirty years in that capacity, he was appointed Chief Ship Surveyor on Mr. Martell's retirement in 1900. Mr. Cornish's earliest practical experiences embraced the completion and preparation for sea of the s.s. *Great Eastern*, in 1858, whilst but a year or two ago he was in constant consultation with the owners and builders regarding the designs of those great Atlantic greyhounds, the Cunard liners *Lusitania* and *Mauretania*, both of which are classed with Lloyd's Register. Throughout the whole of his connection with the Society, Mr. Cornish has been intimately concerned in those developments in the rules, which experience and the gradual evolution of the merchant vessel have shown to be necessary, and the close of his official career has been made conspicuous by the committee's adoption of the Revised Rules for Steel Ships, which he and his



appointed a Surveyor to Lloyd's Register. For many years he was associated with the late Mr. Bernard Waymouth (at one time Chief Surveyor and afterwards Secretary to Lloyd's Register) and in 1867, when the Society's Rules for Composite Ships were formulated, the illustrations of the text drawn by Mr. Cornish were selected from those submitted by other surveyors, as being of exceptional merit, and besides being accepted by the committee, were subsequently shown at the International Exhibitions of Paris and Moscow, where they were awarded bronze and gold medals, and are now in the South Kensington Museum. In 1870 Mr. Cornish was given the post of Assistant Chief Surveyor, under the late Mr.

colleagues at the Registry have been long and carefully preparing. Mr. Cornish will be greatly missed by everyone who has had the pleasure of meeting him in business. His fine presence, upright bearing and courtesy, which has always distinguished him, have made him immensely popular, not only among his London colleagues and friends, but also at every shipping centre, both at home and abroad, which he has visited on the society's behalf. The sincerest respect and esteem of all who know him will follow Mr. Cornish into his retirement, coupled with the earnest wish that he may enjoy for many happy years the rest he has so well earned.

Mr. S. P. J. Thearle has been appointed by the committee

to be the new Chief Ship Surveyor to the Society, he having been, since 1900, the principal assistant to Mr. Cornish. Mr. Thearle's connection with the Society also extends over a long period. He was appointed a Surveyor in 1876, and the greater part of his official career has been passed on the Clyde, and subsequently he filled the appointment of Principal Surveyor to the Society at Newcastle-on-Tyne. In 1893 the committee selected him to accompany Mr. Cornish to the Great Lakes of North America, for the purpose of conducting investigations into the shipbuilding industry of that district, and reporting thereon for the committee's information. Mr. Thearle is the author of several well-known works dealing with the science of Naval Architecture, his book, in two volumes, entitled "Modern Practice of Shipbuilding in Iron and Steel," which has run into many editions, being regarded as a text book by the Board of Trade. He is a member of Council of the Institute of Naval Architects and is fully qualified in every way to occupy the high and responsible position which Mr. Cornish is relinquishing.

On the 25th June, at the Trocadero Restaurant, the Members of the Staff of Lloyd's Register entertained Mr. Cornish to a farewell dinner, which was numerously attended. Mr. James T. Milton, the Chief Engineer-Surveyor to the Society, presided, and in referring in cordial terms to Mr. Cornish's long connection with the Society, the valuable services rendered by him as Chief Ship Surveyor, and to the regret universally felt at his approaching retirement, presented him with a valuable collection of silver plate and a well-filled canteen in token of the high regard and esteem in which he is held by the staff. Presentations were at the same time made to Mr. J. E. Stoddart, Assistant to the Chief Engineer-Surveyor, and Mr. C. H. Jordan, a Principal Surveyor on the Chief Ship Surveyor's Staff, who are also retiring from the Society's service, likewise to Mr. J. Bruhn, D.Sc., who is leaving the Society's service to take up the important position of Director of the Norske Veritas, in Christiania. Speeches were made during the evening by Mr. Andrew Scott, Secretary to the Society, and Mr. S. J. P. Thearle, the newly appointed Chief Ship Surveyor. The proceedings were marked throughout by the greatest harmony, and good fellowship, and were enlivened with musical contributions from various members of the company. The photo is by Mr. Beresford, of Brompton, S.W.

OUR ANNOUNCEMENT.—The 32nd annual volume of "The Marine Engineer and Naval Architect" begins with this issue, and affords a favourable opportunity for intending subscribers to send in their names. They are respectfully referred to the form printed on page xxviii., which should be filled up and sent to the office at 3, Amen Corner, London, E.C. The annual prepaid subscription is 7/6, including postage, sent direct from head office to any address.

The 31st volume, tastefully bound, is now on sale. 488 pages of good reading matter, price 7/6, or by post securely packed, United Kingdom and Canada, 8/-; other countries, 8/6. Binding cases may now be obtained from the publisher, price 1/6, carriage 3d. extra. A complete index to volume xxxi. is presented with this number. We shall be pleased to undertake the binding of readers' parts in publishers' cases at 2/6 per volume. Prices for other bindings quoted for on application. Back numbers in stock.

Shallow Draught Tug for Senegambia.—The *Etienne Watel*, 60 ft. by 10 ft. breadth, draught 3 ft., has just been completed, by Edward Hayes at the Watling Works, Stony Stratford, for Senegambia. She is fitted with two sets of "Hayes" twin-screw, compound engines, having cylinders 6 in. and 12 in. diameter by 8 in. stroke with balanced cranks, steam being supplied by a large marine return tube boiler at 120 lbs. per square inch. The vessel is fitted with holds forward and aft, awning and towing gear. The propellers are specially projected for navigation in shallow water. The speed on the trial trip was just over 12½ miles.

We understand that Messrs. Sir Raylton Dixon & Co., Ltd., have secured a further order from the Rea Shipping Co., Ltd., for a duplicate of the steamer they are now building for that company's general trade.

The "Monitoria."—Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the bunkers of this vessel, and on the tank top under boilers.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

Portsmouth Dockyard.

THE satisfactory conclusion of the naval manœuvres, in which, out of the 370 vessels engaged, only one serious mishap took place, reflects very great credit upon the various dockyard staffs for the attention and care bestowed upon the ships, especially those with nucleus crews or in special reserve in order to make them so efficient. Of this credit a considerable part naturally falls to Portsmouth, which contributed more vessels of all kinds to the combined fleet than any of the other naval ports. During the absence of the fleet on manœuvres advantage was taken to attend to a good many minor matters, and among other things the royal yachts were examined and overhauled, a few repairs and alterations being effected preparatory to their leaving to embark the King and Queen for Cowes week and the royal naval review. The command of the royal yachts, by the way, will be relinquished by Rear-Admiral Sir Colin Keppel next month to Captain Norman C. Palmer, at present in the Mediterranean in command of the *Aboukir*. Sir Colin is to become the Rear-Admiral in the Atlantic Fleet, and will hoist his flag in the *Albemarle*. A visit of international courtesy was made by the battleship *Jupiter* on July 17th and 18th to Havre, in connection with the French President's visit there to open the new quays which have been built. The *Jupiter* is the flagship of Rear-Admiral Paul W. Bush, commanding the local division of the Home Fleet, who was made a Commander of the Legion of Honour by the French President to celebrate the visit. It is now known definitely that one of the two floating docks, for which provision is made in the current Navy Estimates, will be stationed at Portsmouth, at any rate at first, though as soon as the necessary works are in a sufficiently forward state at Rosyth the dock will be transferred there. The second floating dock will probably find a berth in the Medway. £11,232 and £19,400 are the sums set apart for each of these docks in the estimates. The battleships *Exmouth* (flagship), *Canopus* and *Swiftsure*, of the Mediterranean Fleet, arrived on July 6th from the naval manœuvres in order to give leave to their crews before returning to their station. It was at first understood that, though coming north in order to participate in the exercises, the ships from the Mediterranean would not be permitted to give leave at their respective home ports. When, therefore, the Admiralty sanctioned such a course it was reported that it had beeu forced upon them by the crisis in the coal trade, there being insufficient supplies to enable the vessels to return had they been ordered to do so. The report was much exaggerated, and was probably founded upon the action of the authorities in ordering the vessels to reduce speed on a certain occasion during the manœuvres in anticipation of the possibility of a strike, but the First Lord of the Admiralty stated in Parliament, on July 8th, that it was in order to make sure that the reserve of coal would be adequate for any emergency that the speed was reduced on the occasion in question. The armoured cruiser *Good Hope* has been taken in hand for her first extensive refit since completion. Her place as flagship of the Fifth Cruiser Squadron, attached to the Atlantic Fleet, has been taken by the *Drake*, which vessel fulfilled a similar position when the Atlantic cruiser squadron was numbered the Second. Captain the Hon. H. G. Brand took command of the *Drake* on the *Good Hope's* paying off. Under Rear-Admiral F. T. Hamilton, the Fifth Cruiser Squadron is to visit the United States in September to represent Great Britain at the Hudson-Fulton celebrations.

Devonport Dockyard.

Tenders have been invited for the construction of the great new coaling depot, which is to form part of the equipment of the North Dockyard at Keyham, and which it is estimated will cost £50,000. Very little has transpired as to the plans, but there seems reason to believe that the new depot will be by far the most efficient of any in the public dockyards. The motive power used for the machinery which will be required in the delivery and transportation of the coal will be electricity,

the generating station in the north yard being in a position to supply the power necessary, and much more, in fact. Speaking of coaling reminds me that the hulks attached to this yard for coaling ships have recently been overhauled and their various defects made good, the absence of the larger ships of the fleet at the naval manœuvres affording an excellent opportunity for this to be done. Two of the hulks were also provided with new crane and derrick machinery, this necessitating their removal to one of the tidal basins, whereas the others were nearly all repaired at their moorings. Some interesting and important experiments are shortly to be carried out with a view to obtaining information and practice in regard to night firing. The old torpedo boat No. 100, of 96 tons displacement and 23 knots trial speed, is to be equipped as a target for these trials, the conditions of which are as far as possible to be assimilated to those which would obtain during a night attack by torpedo craft. The target will be towed at varying rates of speed, and at all angles. Torpedo boat No. 100 was built as far back as 1886, and for several years has only fulfilled an educational purpose, so that her sacrifice in this manner can be well afforded. The refit of the protected cruiser *Pelorus* is proceeding apace, and her masts have now been taken out and replaced by others of an improved nature. The old masts were of wood, and continued service in tropical climates had somewhat caused them to decay. The new ones, however, are of steel as regards the lower masts, and of wood as regards the topmasts. The height has been increased commensurate with the requirements of the new high-power wireless installation with which the cruiser is to be equipped. The promised account of the cruise of the *Pelorus* up the River Amazon, for a distance of 2,000 miles, has now been published as one of the "Log Series," and contains, besides a very interesting day to day summary of the trip, a series of unique photographs. The *Pelorus* has quite an exceptional reputation by this time, for among other things it was in her that Rudyard Kipling wrote his "Fleet in Being." On completion of her refit here the armoured cruiser *Hogue* is to be commissioned for service in the Home Fleet (Third Division), at the Nore, for which purpose she will draw her nucleus crew from Chatham. There will then be two ships of this type in the Nore Division, the other being the *Cressy*, which is also recommissioning shortly. Three obsolete vessels from this port were included in the sale of old warships which was held at Portsmouth on July 13th, *viz.*, the battleships *Anson* and *Benbow*, launched in 1886 and 1885 respectively, and the ex-sloop *Defiance II.*, formerly known as the *Perseus*. The latter had been serving as a tender to the torpedo schoolship *Defiance* for a quarter of a century, and before that she was connected with Devonport as the ship "used for scrubbing hammocks, etc., for gunnery schoolship Cambridge." As the *Perseus* she was the last but one of the ships stationed on the Thames off the Tower of London as receiving ship and tender, and thus carries us back to the last days of the press-gang. She fetched £1,425, while the *Anson* and *Benbow* were knocked down for £21,200 each, the former to a London and the latter to a Liverpool firm of shipbreakers.

Sheerness Dockyard.

The success of Rear-Admiral Jerram in the naval manœuvres was very popular at Sheerness, especially with the bluejackets. This was the first time that he had hoisted his flag since promotion in command of a fleet, and the manner in which he successfully eluded the ships of the Red Fleet, taking his force (the White) from the North Sea to the Atlantic, was looked upon as a fine achievement. The *Goliath*, in which Admiral Jerram hoisted his flag, returned here from the exercises on July 7th, with the *Vengeance*, and left on the following day to proceed to Chatham. These two battleships were mobilized from the Special Reserve, consisting of ships with seventy men on board to keep their machinery and armament in good condition, and, therefore, the manner in which they survived the test of a fortnight's war training with fully-commissioned ships was very creditable. The gunnery and torpedo instructional ships have undergone their annual refits, these being attended to during the absence of the seagoing ships for the naval manœuvres, during which, of course, the gunnery and torpedo schools were closed and the men under training in them sent to sea. Another ship upon which work has been in progress is the *Isla*, which the Admiralty purchased in the summer of 1907 as an oil-carrying vessel for submarines, at which time the *Kharki* and *Petroleum* were purchased as oil carriers for the larger ships. The *Isla* is rather small, displacing only 980 tons, with 650 horse power. Since 1907 she has been temporarily employed as a collier, but is now being "modified for the purpose of meeting the latest shore storage arrangements," as the First Lord's Memorandum puts it, and should soon be out of dockyard hands. It was stated at one time that many more petrol carriers would be equipped to meet the growing demands of the active fleet in connection with the extended use of oil fuel, but this was before the last two naval programmes contained provision for three dozen torpedo boat destroyers which are to revert to coal. The new ocean destroyer *Nubian* completed her steam trials off Sheerness at the end of June and returned to Woolston to be completed for sea. She is expected to be ready for commissioning during August. In the *Nubian* the displacement has reached four figures, and two boats of the same programme, the *Viking* and *Zulu*, are expected to have still heavier displacements. The speed guaranteed on trial by Messrs. Thornycroft, the builders of the *Nubian*, was 33 knots, which was well maintained. The destroyer *Saracen*, of the previous year's programme, created a record for smartness on the day that she was delivered from the builders' yard at Cowes. She arrived in the Medway on June 25th, and at once was commissioned by Commander Charles Tibbits. After embarking her crew, victualling stores, taking in oil fuel, and making final preparations for sea, she left Sheerness on the 27th, in all respects an efficient unit. She relieved the *Panther*, of 385 tons displacement, which was the last of the "thirty knotters" serving in the First Destroyer Flotilla. The news of the loss of submarine "C. 11," which was transmitted by wireless, was received with widespread sorrow, especially as it came on the eve of the Fleet's visit to the Thames, to which the men were all eagerly looking forward. Prompt measures of assistance were taken. The battleships *Victorious* and *Cæsar* left after embarking salvage stores, while the tug *Diligent* took out a salvage lighter. The torpedo gunboats *Jason* and *Speedy* also received orders to prepare for sea. Both these ships carry mine sweeping gear.

Chatham Dockyard.

The deplorable mishap to submarine "C. 11" and the collision of "C. 16" and "C. 17," gave a shock to everyone at Chatham. The last-named boat was only completed at this yard in the spring of the year, being the first submarine to be constructed in a public dockyard. She proceeded to Portsmouth to join the flotilla there, in which she has remained. Universal sympathy will be felt for the relatives of the lost men. A less startling announcement was that about the cruiser *Sappho's* collision with a similarly-named ship belonging to the Wilson line, of Hull. A very smart response was made to the call for assistance from Chatham. The *Trafalgar* was in basin when the order arrived for her to proceed to Dover, and she steamed through the lock the same afternoon (which happened to be Sunday, a very unusual occurrence) and proceeded to Sheerness to take up the requisite stores. Soon after midnight she was on her way round, and arrived at Dover on Monday morning. Considering that the *Trafalgar* is in special reserve, with a crew of only one-tenth her full complement, this is a creditable performance, and taken in conjunction with the behaviour of the *Goliath* and *Vengeance*, also special service battleships, during the manœuvres, it speaks volumes for the effectiveness of the system as compared with the old *régime* of dockyard reserves. Even more striking as a test of efficiency was the repairing of the *Sappho*. The vessel arrived at Chatham with a breach below the water line of eight feet by four, but despite this extensive damage the vessel left again to resume fleet duties in six days, the dockyard staff working night and day to get the work done. After the King's review of the Fleet, at Spithead, on July 31st, the battleship *Albion* is to be paid off (having already been relieved by the *Implacable*) and placed in the Special Service Division, when there will be four vessels of the *Canopus* class in special reserve at this port. The remaining two of the class, the *Ocean* and *Canopus*, will also join during the autumn on relief in the Mediterranean Fleet by more modern battleships. In October the refit is to be finished of the battleship *Venerable*, which with the *London*, is undergoing a thorough overhaul. Regret has been expressed that the last-named

ship was unable to be present at the visit of the Fleet to the Thames, since as the namesake in the Navy of the City of London she would have been an object of much attention. This, however, was quite out of the question, as besides being out of commission the *London* could scarcely have been made "ship-shape" in the time allowed. The *Venerable* will make way for the *Irresistible*, and the *London*, when completed, will be succeeded by the *Bulwark*, when all eight ships of this class will have been modernized and brought into line with the latest improvements in their different departments. The second-class cruiser *Naiad* was brought in at the end of last month from the River Stour to be converted into a mine-laying vessel. She was launched at Barrow in October, 1890, and not commissioned for many years later, while in 1905 she was struck off the effective list as being of little or no fighting value, so that altogether the *Naiad* cannot be said to have been the best of bargains. The *Intrepid* and *Tribune* (the last-named a sister of the *Naiad*), as well as the *Pactolus*, are also on the list for conversion into miners. By September next five ships of this description will be on active service. Rumour has it that one of the four new cruisers of the *Bristol* class, for which provision was made in the Estimates, will be called the *Chatham*. At present this is rumour and nothing else, for it is doubtful if any names, as regards these four vessels, have been decided upon, but it would nevertheless be a popular move on the part of the authorities to revive this old and interesting ship name. From the date of the Battle of Barfleur, in 1692, until the year of Rodney's victory over De Grasse, nearly a century later, the doings of ships called the *Chatham* were almost continuously prominent in our naval records, though since then the name has never found a place in the list of the Fleet. Rear-Admiral R. N. Ommanney succeeds Vice-Admiral Giffard as Admiral Superintendent on August 9th next.

Pembroke Dockyard.

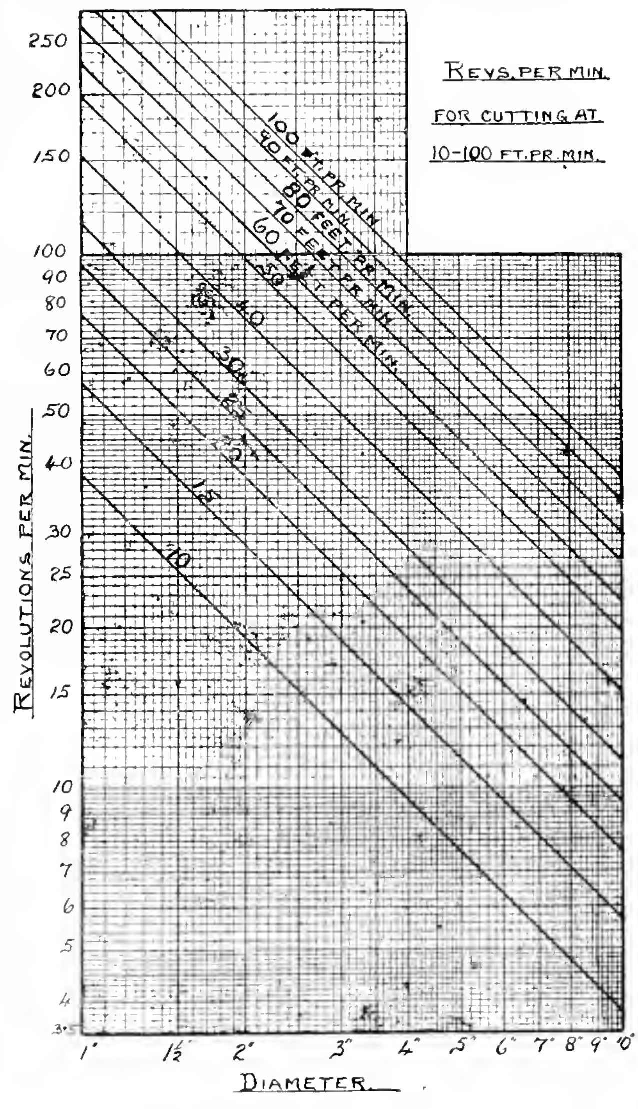
The unarmoured cruiser *Bellona* is making rapid progress towards completion, and she is to be dry-docked some time during August. Her successor on the stocks, the *Blanche*, is to be put afloat on November 11th, next. There will be approximately an interval of twenty years between the launch of this vessel and that of the ship which previously bore her name. The old *Blanche*, a third-class cruiser, was launched at Pembroke dockyard on September 6th, 1889. The dimensions of the two vessels, both built at the same yard, afford an interesting comparison :—

	1889	1909
Displacement, tons	1,580	3,350
Indicated horse-power ..	2,800	18,000 (turbine)
Nominal speed, knots ..	16·5	25·0
Length, feet	220	385
Beam, feet	35	41½
Draught, feet	14	13½
Armament	Six 4·7-in. Four 3-pdr. Two machine.	Ten 4-in. Machine guns, Number unknown.
Coal capacity, tons	160	450

From the above figures many interesting deductions may be obtained, though space will not permit of their being discussed here. The turbines for the *Blanche* have been ordered from Messrs. Hawthorn, Leslie & Co., and will be of similar power to those fitted in the *Boadicea* and *Bellona*, the first and second vessels of the new class. The former, as stated last month, becomes flagship of the First Destroyer Flotilla in place of the *Topaze*, or, as she is nick-named by the bluejackets, the "Topsy." The refit of the destroyer *Violet*, which has been at this yard for over four months, has been the subject of communications between the Admiralty and the dockyard authorities. The boat was to have been ready for sea by May 30th, but owing to trouble with the boiler tubes, to which reference was made last month, to get the vessel efficient by that date was not possible. The Admiralty made an extension of time for the work to be finished, but impressed upon the dockyard officials that the *Violet* was wanted as soon as possible. It was, in fact, intended to have her commissioned for the manœuvres. It became obvious however, that this could not be done, and the matter ended by the dockyard undertaking to use every possible means to have the destroyer ready by the middle of July. In this, however, they did not succeed. The *Violet* is certainly a most unfortunate vessel. Since her collision on July 9th, 1907, with a sailing vessel, in which she received such extensive damages that the forepart of the boat had practically to be rebuilt, she has spent the greater part of her time in dockyard hands. It was not until the beginning of the following December, or five months after the mishap, that the repairs of the vessel were completed, while those practically finished were decided upon as far back as last October. Some useful work is being found for a number of men by the building of targets for the battle practice of the Fleet. Two of these are approaching completion, and probably will be ready for use by the time these lines appear. They are built of pine logs, and are 140 feet in length. The keel is weighted with steel waste, as it is by it alone that the target can be made to float vertically. The increase in the number of targets now used is also a good thing for those firms who formerly used to buy for purposes of breaking up the old "wooden walls" of a bygone era, but who have now to be content with such things as old targets when what wood there is at present on scrapped warships is nearly all fire-resisting.

JUNIOR ENGINEERS.

THE application of the previous sets of curves for high-speed steel gives the cutting speed for any particular cut, as regulated by the power required and available, assuming a constant peripheral speed for all diameters, with

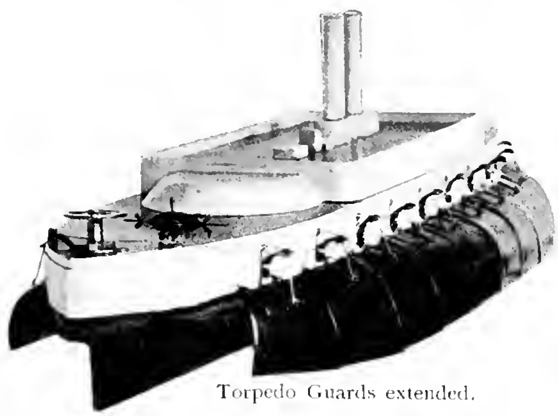


their way through the net which in actual warfare would mean instantaneous destruction of the vessel so attacked.

Since the first review in our journal Dr. Jones's new system of torpedo defence has been considerably improved upon, *viz.*, the means of operating his torpedo guard by avoiding altogether any perforation of the hull. By means of hawsers the buoyant steel plate defence is lifted into its defensive position and by a reverse action the guard is pulled closely into the ship's side when not required in defensive position. Thus the speed of the vessel will be in no way materially lessened and the rapidity by which this defence can be brought into and out of defensive position is doubtless a great consideration when the mobility of a fleet is considered in time of war.

To do the inventor justice we must say that these improvements have been sufficiently dealt with by him; he has also secured two other very important factors, rigidity and almost entire absence of deadweight by the present means of construction, and therefore all causes of such objections which might apply to an earlier modification has been entirely removed by his present system of buoyant steel defence, and this result has been attained in a very simple manner.

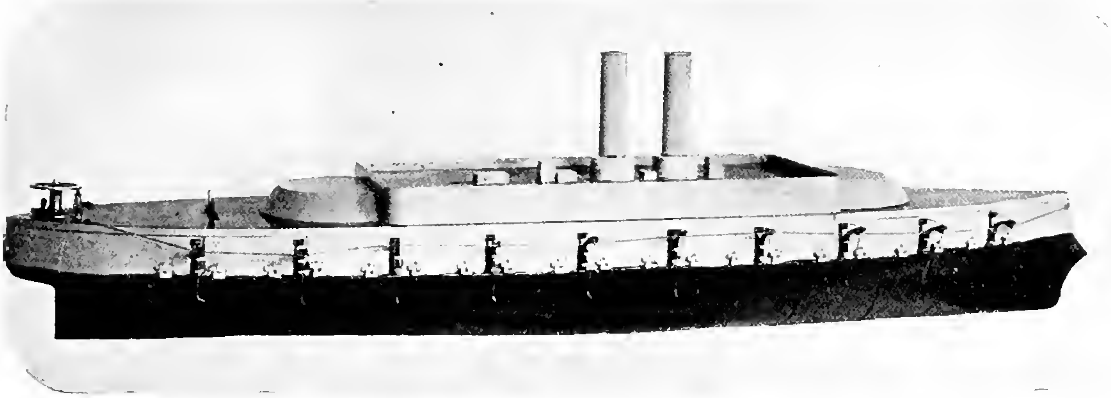
We illustrate a model of a ship fitted with the steel plate guard, the illustrations showing the guard in extended and closed positions.



Torpedo Guards extended.

The late Sir E. J. Reed, the great naval architect and battleship constructor, and other naval authorities whom we have cited in this and in our previous articles, namely, Rear-Admiral Sir Sydney Eardley-Wilmot, R.N., are unanimous that this improved invention should be put to a practical test, and we give here the opinions of these gentlemen. Sir E. J. Reed says:—

"I have examined the patent specifications, models, and documents, descriptive of the torpedo guard for ships of war, of Dr. H. G. Jones, of Great Russell Street, London, and have come to the conclusion that it is so well conceived and designed for the important object which the inventor has in view as to deserve practical development upon a working scale. In view of the enormous experimental and actual outlay in all the navies of the world upon torpedo defences of mere network, it may be presumed that it is of vital advantage to arrest an approaching torpedo at a distance of several feet from the bottom of the attacked ships. These net defences are assuredly much inferior in many respects to the sheet-steel defence provided by Dr. Jones, especially as regards the relative quickness and efficiency of bringing them into and out of position, operations for which Dr. Jones makes provision by most ingenious, but perfectly sound, mechanical arrangements. Nor must I omit to mention that the torpedo guard of Dr. Jones protects the bilges of the ship, from the keel outwards, in a manner totally unapproached by the net system, or any other system with which I am acquainted."



Torpedo Guards closed.

Rear-Admiral Sir Sydney Eardley-Wilmot, writing in reference to torpedo nets, remarks:—

"Being only suspended from the upper side, they hang loosely down and remain in this position when the ship is stationary. So arranged, they at one time sufficed to stop a torpedo travelling at any depth up to 20 ft.

"But should the ship move through the water, the nets are more or less impelled towards the surface, according to the speed of the ship, and when this exceeds four or five knots, the strain on the booms becomes too great. Hence, it has not been considered practicable to have this defence in position when the ship is required to move at speed, and even if this were possible, the nets, owing to their sagging towards the surface, would afford little protection. For these reasons naval officers do not consider nets can be used at sea.

"And even with the ship at anchor, the nets are not reliable. A cutting arrangement has been devised which, when attached to the fore-end of the torpedo, enables it to pass through the net. Without this apparatus, moreover, the impetus of the torpedo forces the netting considerably towards the ship, and when arrested the explosion of its charge may then take place in dangerous proximity to the vessel.

"Thus, it is evident, that if external protection is to be relied upon, it must be in a different form, and Dr. Jones has devised a torpedo guard which is not only novel, but free from most of the objections inherent to the net defence.

"This plan now proposed by Dr. Jones is, in my opinion, the best which has yet been put forward for guarding against the terrible effects of locomotive torpedo attack; and looking to the grave issues involved, I consider that expenditure would be wisely incurred in giving it a thorough trial."

Beyond this the improvement in submarine navigation and engineering skill having been for the last few years constantly at work perfecting submarine vessels and torpedoes, the time has arrived for the claims of Dr. Jones to be considered and in view of the opinions expressed by Sir E. J. Reed and Rear-Admiral Sir Eardley-Wilmot, expenditure would be wisely incurred in giving Dr. Jones' invention a thorough trial. To do this and without further delay is an obligation binding on those officially responsible.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Labour Troubles and Holidays. The trouble that has been pending in the coal mining industry, ever since last month's notes were written, has as yet not reached a crisis, but this is certainly now imminent, and the unsettling effects of the situation are daily being intensified. The reduction in miners' wages sought to be imposed was further discussed at the adjourned meeting of the Miners' Federation of Great Britain, held in London on July 16th. It was decided that the members should be balloted on the question of putting the rule into force, which provides that when any district is attacked on the wages question all the members of the society shall tender notice terminating their contracts. The returns of the ballot are to be made to the general secretary and a special meeting of the Federation will be held to consider the situation. It was announced that a joint conference of Scottish coalmasters and miners' representatives would take place in London or in Scotland on July 22nd, under the chairmanship of the president of the Board of Trade to try and effect a settlement. Meantime, the shipbuilding, marine engineering and steel and iron industries of Clydeside have "shut down" for the annual "Fair Holiday" period. In the case of many of the large iron and steel works the holiday period has been curtailed greatly, with the object of adding as much as possible to production before the general paralysis which will ensue should the threatened coal strike eventuate. In some cases also even the miners are dispensing with holidays and continuing to work, thus receiving a week or ten days' employment before the strike can come into operation. In many of the shipyards and engine shops, on the other hand, the holiday period has been extended, and labour will not have been resumed until about the end of July or early this month.

New Channel Steamers.—The Fairfield Shipbuilding and Engineering Company, Govan, launched on July 3rd, the twin-screw steamer *Oranje Nassau*, the second of three vessels they are building for the Stoomvaart Maatschappij Zeeland, of Flushing. The first of the three, the *Prinses Juliana*, was launched on May 22nd, and is rapidly being completed for service. The last of the three will be named *Mecklenburgh*. She is being built with remarkable speed. The hull occupies the blocks vacated by the *Prinses Juliana*, and already the plating is well forward. The three vessels have been specially designed for the night service between Flushing and Queenborough, and are 363 ft. in length overall, 45 ft. 4 in. in extreme breadth, 25 ft. 10 in. in depth to upper deck, and of about 3,000 tons gross. There are five decks—lower, main, upper, promenade and boat—and ten watertight bulkheads extending to the height of the main deck. Special features in the design are the large number of one-berth cabins, the minute sub-division of the hull by watertight compartments, and the provision of submarine signalling and wireless telegraphy apparatus. The propelling machinery of these fine vessels consists of two sets of inverted, direct-acting, triple-expansion engines, each set having four cylinders and four cranks. The engines are balanced on the Yarrow, Schlick and Tweedie system, and have been specially designed for quiet and steady running at high speed. Steam is supplied by four double-ended boilers adapted for forced draught on an improved arrangement of Howden's hot-air system, with open stokeholds. The connection of the Fairfield Company with the Stoomvaart Maatschappij Zeeland extends back to the time of the formation of that shipping company over thirty years ago. All the vessels have been built by the Govan firm. Of the steamers in the existing fleet one was built in 1887 and three in 1895. The three at present being constructed at Fairfield will easily rank as the finest in the fleet, and should result in further popularizing the Flushing-Queenborough route.

New Contracts. There has not been the same briskness in booking fresh contracts on the Clyde as obtained in May and June. Several good contracts known to be in the market have been reported as definitely placed, but confirmation in most cases is yet awanting. The large new liner of 10,000 tons, for which the Anchor Line some time ago invited tenders, has not yet been definitely placed, but rumour has been busy with the names of three likely firms, *viz*: Messrs. D. & W. Henderson, Partick; Messrs. Barclay, Curle & Co., Whiteinch; and Messrs. A. Stephen & Sons, Linthouse. The latter firm have secured the order from the Royal Holland Lloyd Co., of Amsterdam, for a further addition to their mail and passenger fleet to South America. This is for a twin-screw steamer of the same high-class as, but larger and speedier than, the *Hollandia*, completed by Messrs. Stephen some months ago. A sister ship to the *Hollandia*—the *Frisia*—built by the Royal Shipbuilding Company de Schelde, at Flushing, left on her maiden voyage to the River Plate on July 20th. These vessels have each accommodation for 80 first-class, 115 intermediate and 1,200 third-class passengers. The new and larger vessel just ordered from Messrs. Stephen is to be named *Zeelandia*. It is stated that the Belgian Government has ordered from Clyde builders two large mail turbine steamers for the Dover-Ostend service, to be completed by next spring. The Sewage Committee of the Glasgow Corporation, having again considered the ten offers received for the building of an additional sludge steamer for the department, have agreed to recommend that the order be placed with Messrs. Wm. Beardmore & Co., Ltd. The amount of their offer was £25,500. The Dutch Government have recently entered into a contract with Messrs. Yarrow & Co., Ltd., for the construction of two destroyers of the most modern type. Messrs. Yarrow & Co. last year supplied to the Austro-Hungarian Government two small shallow draught gun boats, for service on the Danube, propelled by internal-combustion engines, and the same Government have just ordered two similar vessels. In this case only the machinery will be made by Messrs. Yarrow & Co., the vessels themselves being built by the Danubius Company, Budapest. Messrs. Paton and Hendry, Glasgow, have, on behalf of Australian owners, contracted with Messrs. Murdoch & Murray, Port Glasgow, for the construction of a twin-screw passenger and cargo steamer, the engines and boilers for which will be supplied by Messrs. David Rowan & Co. Messrs. Bow, McLachlan and Co., Paisley, have received from the Admiralty an order to construct a steam mooring lighter.

New Type of Dredger.—Messrs. Wm. Simons & Co., Ltd., Renfrew, have recently designed—consequent upon the very successful work done at the Sewri-Mazagon Reclamation, Bombay, by the suction cutter dredgers *Jinga* and *Kalu*—a powerful suction hopper dredger, fitted with a suction pipe and cutter, which they have styled the "Simons" dredger. It embodies some special features, which they have protected. It is claimed for these special features that a vessel fitted with them will, in most materials, do the same duty as bucket-ladder dredgers. The new dredger has not so many parts as ordinary bucket-ladder dredgers, for it works without upper and lower tumblers and without buckets, links and pins, which are liable to wear, and it is expected that the new type will be much less costly to repair and maintain. Economy in maintenance is naturally of the greatest consequence, both to contractors and to harbour authorities, who have to meet the requirements of huge ships which are built and are building. In addition to dredging material from a channel the vessel can carry the material dredged to some other point, say fifteen or twenty miles away, and can then lift the material out of its hopper and deposit on shore or over a quay wall.

Improved Gold Dredgers.—Messrs. Lobnitz & Co., Renfrew, have completed the shipment of the third gold dredger which they have built this year fitted with patent propulsion screen. The device takes the place of the usual sluice-box or revolving screen and elevator in gold dredgers. The third vessel launched has been built to the order of the Syndicat Mana, for French Guiana, the previous ones having been built for the Inambari Gold Dredging Concessio Ltd., Peru.

Torpedo Destroyer "Swift."—The 36-knot torpedo boat destroyer *Swift*, built by Messrs. Vickers, Sons & Maxim, of Barrow, has again resumed trials on the Clyde measured mile. Since the vessel arrived in the Clyde towards the end of last year frequent experiments have been made with various types of propellers for the purpose of obtaining the highest possible speed. In the meantime she is fitted with three-bladed propellers, but according to present arrangements she will shortly enter the Garvel Graving Dock, Greenock, and have these replaced by a four-bladed set.

Dundee Submarine Repair Depot.—Intimation has been definitely received by Dundee Harbour Trust that the arrangements between the Trustees and the Admiralty for the use of West Dry Dock, Dundee, as a submarine repair depot had been confirmed. The Admiralty are to get exclusive use of the dock and other facilities, for which they are to pay £4,000 per annum on a five years' lease, and the arrangements are to be completed and the dock ready by the end of August.

Dundee Shipbuilding.—The Caledon Shipbuilding and Engineering Co., Dundee, on July 6th, launched a screw steamer of 2,000 tons, named *Gowrie*, for the Dundee, Perth and London Shipping Co., intended for the Dundee and Hull trade. The vessel is 250 ft. in length by 32 ft. moulded breadth, and is fitted with the most improved machinery for the handling of cargo. The Caledon Co. have received from the Dundee Harbour Trustees an order for a new ferry steamer for Dundee and Newport service. On July 13th, a third company of shipyard employees—fifty in number—left Dundee, for Montalcane, near Trieste, Austria. This wholesale migration of shipyard workers to Austria, as explained in last month's note, is accounted for by the amalgamation of shipbuilding concerns, and the great expansion of shipping and shipbuilding taking place, due largely to government bounties. For the Austrian-Lloyd Steam Navigation Co., alone, eight steamers are now under construction. This company propose to build immediately two fast turbine steamers for their Trieste-Alexandria service, and to turn their attention to fast turbine steamers for other of their passenger services.

Proposed New Clyde Graving Dock.—The special committee of the Clyde Navigation Trust, which has been considering the question of a large new graving dock for the port has submitted to the Admiralty a draft scheme providing for a dock in their ground at Elderslie, a little to the east of the Burgh of Renfrew. The graving dock proposed is intended to fit in with a larger scheme for the commercial dock in this neighbourhood. After the Admiralty have examined the plans it is likely that a deputation from the Clyde Trust will be received in order to discuss the matter, and to hear what attitude the Government may adopt in regard to the proposals. The plans submitted to the Admiralty show a large graving dock running parallel to the river in the ground a little to the east of the new harbour workshops at Renfrew. The entrance to the dock is from the west or Renfrew end, where there would be a large canting basin. In accordance with the remit under which they are constituted the committee have so designed the graving dock that it will fit in with plans for a large commercial dock in the same vicinity, and the canting basin will, besides allowing an easy entrance to the graving dock, form a canting basin for the Renfrew end of the commercial dock, and when the latter is completed the graving dock will be but a part of the very much larger scheme. The site chosen is some distance below the bar in the river known as Elderslie Rock, so that if further depth of water were necessary for the purposes of the graving dock, or to fulfil the Admiralty requirements, the trustees would not be faced with the heavy task of deepening the river still more at that most difficult spot.

THE TYNE.

(From our Own Correspondent.)

A Great Spanish Contract.—It is something to be proud of that an English syndicate in which Messrs. Armstrong, Whitworth & Co. are prominently concerned, has secured against all competitors the contract—computed as being worth some £7,000,000 sterling—for providing the Spanish Government with a new navy consisting of battleships, cruisers, gunboats, torpedo boats, destroyers, etc. This proves that for design, capacity of equipment and possibilities of quick execution in warship building Britain still holds the field, and in view of recent "scares" and rumours of "deterioration," this outstanding fact gives special cause for gratification. Part of the work, it is understood, is to be carried out in Spain; but notwithstanding this arrangement, it is certain that the acquisition of the contract will prove of immediate and material benefit to British industries. Simultaneously with the foregoing comes another announcement of exceptional interest, namely, that Messrs. Hawthorn, Leslie & Co. have completed arrangements with the Canadian Government, by which they will be concerned in the building of five cruisers and twenty torpedo boats or destroyers. The founding of a new shipbuilding yard on one of the Great Lakes is projected, and it is understood that a large proportion of the work is to be completed there. The opening of a new yard in Canada will doubtless cause an exodus of shipbuilding operatives from this country. It is fortunate that there is a prospective opening for them somewhere, for prospects here are not by any means encouraging.

Messrs. Swan, Hunter & Wigham Richardson.—It is stated that this enterprising firm have undertaken the building of a large pontoon dock for the Admiralty, and that work upon the contract will very shortly be commenced. The dock is to be, in the first instance, located at Jarrow Slake, but will be so constructed as to be removable to another site when necessary. This firm have booked some commercial orders lately, and it is hoped that the yard will present a busy appearance shortly.

The Palmer Company.—The state of work in this company's shipbuilding department is daily becoming busier, and room has been found within the past week or two for many of the old hands who have long been awaiting a "start." In other departments improvement is also apparent, and the prospective placing of a Government repairing dock at the Slake is enabling Jarrow to breathe freely again. The Tyne Dock Engineering Company have obtained the contract to carry out extensive repairs and a survey on the steamship *Kingswell*. The repairing establishments at Shields are not particularly busy at present, but in some cases there is a prospect of more work coming to hand shortly. Several firms have, it is stated, tendered for the carrying out of repairs to the steamship *Highland Monarch*, now lying in the Clyde.

The Engine Works.—At many of the leading marine engineering establishments there are signs of improving business, and in some cases partial night shift has been adopted. The ordering of new steamers, however, is not so brisk as it was a few weeks ago, and hence a feeling of uncertainty as to the future has been brought about. It is probable that the advent of the Spanish and Canadian contracts, already referred to, may tend to stimulate business in the later months of the year. Manufacturers of auxiliary machinery have, for the most part, only a limited amount of work in hand; but the specialities of Messrs. H. Watson and Sons, High Bridge Works, Newcastle, are still in demand, and the different departments are kept going very satisfactorily. The machine tool works of Messrs. Noble and Lund, Felling, continue in steady operation, and Messrs. Newton & Nicholson's packing works, Tyne Dock, are still kept going briskly. Some of the iron foundries at this centre have become busier lately, and the improvement is likely to be maintained.

THE WEAR.

Shipbuilding.—It was our pleasing duty last month to report the placing of orders with a number of firms, and appearances then pointed to an early return of briskness to the port. The spurt in business, however, has proved but short-lived, and things again appear to have fallen very flat. We have, however, to report the receipt of an order by Messrs. J. L. Thompson & Sons, of the North Sands Yard, of a 7000 ton ship for Messrs. Woods, Taylor & Brown, of London, the engines for which will be supplied by Messrs. Richardson, Westgarth & Co., Sunderland. At the North Sands Yard there are now two keels laid, and a third berth is being prepared for the reception of a keel. Messrs. Doxford and Messrs. Osborne & Graham are reported to have booked more orders, but this can scarcely be said to be authentic. There is as yet no sign of the long-talked of re-opening of Messrs. Laing's yard. At Messrs. Austins a new steamer of special design is being completed and fitted out at the quay and the steamship *Tuskar* is receiving extensive repairs on the pontoon. Messrs. Robert Thompson & Sons have been quite busy, both in the shipbuilding and graving dock departments, during the past month. A good deal of timber

has been imported during the month, and it is reported that much of this is intended for use in the shipyards.

It is announced that an order for two large steamers for the Prince line has been placed with a leading shipbuilding firm on the Wear, by Mr. James Knott, Newcastle, the Chairman of the Company.

Engineering.—The steamship *Heatherside*, which was launched on the 15th instant by Messrs. Short Bros., has been brought to Messrs. Dickinson's quay to be fitted with her engines and boilers. Business is not quite so brisk at some of the marine engine works as it was a few weeks ago, and at the auxiliary machinery establishments the volume of trade has become distinctly lessened. One or two of the local foundries have become busier, but in other cases slackness is still very apparent.

THE TEES AND HARTLEPOOLS.

(*From our Own Correspondent.*)

Middlesbrough.—Trade locally may be said to have improved slightly. The Newport Rolling Mills of Messrs. John Hill and Co., which were closed some weeks ago owing to slackness generally, have been restarted. At Messrs. Sir Raylton Dixon & Co.'s Cleveland Dockyard work is better than it has been for some time, having booked orders for four vessels, two of 6000 tons and two of 8000 tons deadweight. The two shelter-deck boats of 360 ft. long will be fitted with their well-known top side tanks associated with the name of the builders. The firm have now secured work sufficient to keep them well employed all through the winter. Messrs. Harkess are also fairly well supplied with work. It is reported that Messrs. Elder, Dempster & Co. of Liverpool, have placed the order for two steamers to be built locally, the engines, for which are to be supplied by Messrs. Blair & Co., Stockton, and the North-Eastern Marine Engineering Co., Sunderland. At Messrs. Richardson, Westgarth & Co.'s engine works work has improved slightly, they are reported to have secured two contracts for marine engines, which, with their other work, will keep them fairly busy for some time.

Stockton and Thornaby.—Messrs. R. Ropner & Sons have secured the contract to build two steamers to carry about 5000 tons deadweight each on a light draught. The other yards are being kept fairly well occupied. Messrs. Blair and Co. have secured the contract to engine two new steamers to be built by Messrs. R. Thompson, Southwick Yard, Sunderland, one for Messrs. The Union Steamship Co. of London, of 5100 tons deadweight on a light draught, also one for Messrs. The Gordon Steamship Co., Ltd., London; a fast collier of about 2600 tons deadweight which, with their other work on hand, will keep them fairly busy for some months to come. Generally, however, the outlook is not very promising for Stockton and district.

West Hartlepool.—Trade is very little, if any, better than the previous month. Messrs. W. Gray & Co. have two cargo steamers to lay down for Norwegian owners, also two for British owners, all of rather large size; they are also reported to have secured a contract to build and engine (at their Central Marine Engine Works) a steamer of about 6000 tons deadweight for Messrs. T. Stevens & Sons, London. Enquiries, however, are somewhat better for good work, and rumours are current that a twin-screw cargo boat and a passenger steamer are expected to be secured locally. At Messrs. Irvine & Co.'s dockyard yard the first Elder, Dempster boat has just been launched, the second is nearly plated, and on the recently vacant berth the keel for a new steamer has been laid, and along with the floors which are nearly all in position, work is being pushed on rapidly at this yard.

Hartlepools.—At the Middleton Yard of Messrs. Irvine Shipbuilding and Dry Dock Co., Ltd. (the co-partnery yard), work is fairly busy. The steamship *Napoliana*, recently launched by them to the order of Messrs. Furness, Withy and Co., has been sold to Messrs. Burts and Partners, of London and rechristened the *Armston*, also the steamship *Appennine* to the Gulf Line of London and Greenock. They have secured the contract to build a steamer of about 6350 tons deadweight for Messrs. Milburn & Lund, of Whitby, to be delivered in March next, and the contract price is said to work out at about five guineas per ton deadweight. It is also rumoured that they are likely to secure the contract to build a sister ship to the *Teessider*, recently built at the dockyard yard of this firm, which has given such excellent results. At the Harbour Yard they have just launched the steamship *Songa* built to the order of Messrs. Elder Dempster & Co. Sir C. Furness stated that Sir Alfred Jones had that day placed a further order for three boats, the engines and boilers to be built by Messrs. Richardson, Westgarth & Co., Ltd., Hartlepool. Good progress is being made with a small boat for Mr. H. Christensen, shipowner of Antwerp. The dry docks of this firm have been well employed during the month. The steamship *Netherton*, which was illustrated in last month's issue, has been in Messrs. W. Gray & Co.'s dry dock for survey and to enable various firms to tender for the repairs required to the fore part. From the illustration can be easily seen the ingenious method adopted to stiffen and strengthen her longitudinally by securing H girders, one on either side by knee plates to her sides forward. I understand there will be some difficulty to repair her, as she is joggle-plated, which will necessitate very careful handling of the plates when straightening them, also that she is likely to go to the Tees for repairs. At Messrs. W. Gray & Co.'s Central Marine Engine Works very little change has taken place during the month, the firm being kept busy with the engines required for the various boats building at both the old and new yards; also with their various specialities. Messrs. Richardson, Westgarth & Co., Ltd., have secured the order to engine the steamer building for Messrs. Milburn & Lund, Whitby, previously mentioned, also the engines of about 800 h.p. for a cargo boat building by Messrs. Irvine's Shipbuilding and Dry Dock Co., Ltd. They are reported to have secured the contract to build a very large contraflo condenser for America. The foundry is kept very busy, which now does all the castings for the Middlesbrough works of this firm. As trade generally is so slack they have now been reduced to five-eight time, which no doubt is due to the unsettled state of the coal trade. As several very good enquiries are reported to be in the market it is expected that work will resume its normal condition after the holidays. The co-partnery scheme has been rejected by the men at Wingate Colliery, recently purchased by Messrs. C. Furness and Partners, but I hear that, as it was settled in a somewhat hasty manner by the men and at the instance of their trade leaders, Sir C. Furness is likely to put the matter before them again in a manner which is hoped will prove successful.

THE HUMBER AND DISTRICT.

(*From our Own Correspondent.*)

Messrs. Earle's Shipbuilding and Engineering Co., Ltd.—This firm, who have lately renovated their yard and installed up-to-date machinery driven by electricity from the Corporation mains, are in the position to build from a trawler to a "Dreadnought" for the Government. A very large amount of money has been spent by them and it is now hoped that the English and foreign governments will give the firm a chance in tendering for any shipbuilding or engineering work. They were successful last week in securing an order from the British Government for a large tug boat, costing somewhere about £24,000. The repair work keeps the yard fairly busy. The Wilson liner, s.s. *Dago*, has arrived from the Baltic, after being sunk all the winter. Salvage (London Co.) raised her and towed her into Libau, a Russian port in the Gulf of Riga, where they planked her up and secured a cargo of wood for Hull. The boilers and machinery and the dynamos worked without a hitch all the way to Hull, even after a long winter's immersion in the Baltic sea. She now awaits the Underwriters' and Steamship Co.'s decision. She is only about six years old and a fine steamer, but the cost to put her into commission again will be a very heavy consideration.

The steamer *Kossuth Ferenz*, which went ashore on the Goodwin Sands, has now been discharged of her cargo of grain, and been placed in the Alexandra Graving Dock to see the nature of the damage, which is very serious, and different shipbuilders from the Tyne, etc., have, I believe submitted prices, which I understand are very heavy indeed. It is sincerely hoped that some local firm will get the work

to make her fit again for commission, which would relieve a good amount of distress in East Hull.

Humber Ironworks (Bailey & Leetham), Engineers, boilermakers and ship repairers.—This yard has been fairly busy during the past month with engine and slip work, and have at present on their slip s.s. *Kalmar*, of Hamburg, the bottom of which is seriously damaged, having been ashore. They have also had several inquiries for new boilers and machinery.

Central Dry Dock and Engineering Co., Ltd.—This firm is still leading in docking of steamers, the steamer *Freidheim*, of Tonsberg, Norway, has been ashore in the Baltic and got her bottom knocked up seriously on the rocks. She has had over forty new plates put in, also new floors and other extensive repairs, and has been in dock about ten days. The company has also had a great number of steamers under repair in Alexandra Graving Docks, and they have abundance of work in hand.

Messrs. Cooper & Co., Engineers and Boilermakers.—This firm are always securing docking and repair work, and seem to secure a large share of outside steamers. They are fairly busy and employing a number of men.

Messrs. Amos & Smith, Ltd.—This firm are lacking fresh orders, but seem to get their fair share of general repairs. One of the officials is away at present in France. We trust he will come home with several fresh orders.

Messrs. Stewart & Craig, Engineers and Boilermakers, Alexandra Dock.—This firm are keeping fairly busy with outside repair work, and keep gaining ground amongst the shipowners.

Messrs. Cook, Welton & Gemmell, Shipbuilders, of Beverley. This firm, who were in business at Hull for many years, are now at Beverley. They are large builders of trawlers, but through depression in the fishing business they suffer lack of orders, like all other shipbuilders throughout the British Isles. They just launched the other day a steam steel trawler, *Konig Frederik III.*, to the order of Mr. Frank Barrett (Mayor), of Grimsby. The principal dimensions are: Length B.P., 125 ft. by 22 ft., moulded breadth by 11 ft. 9 in. depth of hold. The machinery is being supplied by the Great Central Engineering Co., Ltd., of Grimsby. The sister vessel, the *Minoni*, is also ready for launching for the same owner. Steam windlass and steering gear are being supplied by Messrs. Gemmell & Frow, engineers, Hull. We understand they have two large trawlers to build for local owners.

THAMES.

(From our Own Correspondent.)

Fleet's Visit.—The event that crowns all others is that of the visit of the Navy to the river. We have had a few torpedo boats at London Bridge before, but never has it been possible to record such an occasion when the Navy has paid us the compliment of a demonstration like the present one. Of such dimensions, stretching from the Houses of Parliament down to the Nore, it was indeed a happy idea of the Lord Mayor to suggest what has led up to the recent grand display. It is not only London that has benefited, but the whole country has been stirred by its loyalty. Excursionists from distant parts have shared in the enthusiasm as much as the riparian residents, and that the beginning was marred by the sinking of a submarine on her way to the Thames served perhaps as an added interest to the occasion. The new Port of London authority took a prominent position at the reception, owing to the jurisdiction they have over the river, but it was naturally left for the city from whom the idea emanated and who did the bulk of the entertaining to have first place, and it may be truly said that the arrangements were carried out from first to last in a manner that did credit to all concerned. The moorings that required laying down was in itself no small matter, and the getting such a number of craft up and down the reaches of the river with the additional traffic given by the sightseers, must have furnished some anxious moments to those charged with the safety of the vessels engaged. The number of the visiting squadron is given as 150 ships of all classes.

County Council Steamboats.—The Council does not find itself able to readily dispose of the boats on its hands. The remaining twenty-one boats were offered to auction on the 13th of last month at the Baltic sale rooms. The names given at the outset to these boats were classical, but this has not been sufficient to ensure a success to the venture, and now we find them going at one-twelfth of what they cost to build. One boat went at £700 and others at £500, the total for five boats being £2,705. There are thus still sixteen boats left to dispose of. An offer is said to have been accepted for the purchase of these in one block.

Thames Conservancy.—It is well known that with recent changes the Conservancy has lost that importance it formerly had when it controlled the full length of the river, and it has been proposed to remove the head-quarters from London to Reading. The proposition, however, was negatived and finally the committee decided to take offices in Norfolk Street, Strand, no doubt, with a general view to economy.

Port of London Appointment.—Recently the new authority advertised for a chief engineer, and the result has been the appointment of Mr. Frederick Palmer, at present chief engineer for the Port of Calcutta, to the new post. This gentleman is said to have had a large share in the development of the Indian port and a large experience in dock and river engineering.

Thames Bridge Proposals.—London was startled recently by a truly grand proposition for a bridge across the river on new lines entirely. It was to leave the foot of the present Southwark Bridge at the junction of Southwark Bridge Road and Southwark Street and strike diagonally towards the river and then head to St. Paul's, thus forming a complete new artery, north and south. The gradients of Southwark Bridge were to be improved also and a sum of money amounting to £1,646,963 to be spent for the larger project and £231,000 for the smaller one. In the result the larger question is referred back and the proposal to improve Southwark Bridge carried.

Imperial College of Science.—The King and Queen were present at a great function at South Kensington and laid the foundation stone of the new buildings, His Majesty making a notable speech in favour of technical education. The new buildings will complete the scheme inaugurated fifty years ago by the late Prince Consort, to the engineering department being assigned the whole east block.

Training Ships.—The Lord Mayor presided at the training ship *Warspite* inspection and presented the prizes. He eulogized the mercantile marine and described it as of equal importance with the Navy as a career. Another training ship on the river that has had its annual holiday has been the *Cornwall*, at Penfleet.

Yachting.—The Corinthian Club has organized international races from the Thames estuary and these were well attended, the courses being from Port Victoria to Ramsgate. Four races in all were held, the Belgians being the principal Continental representatives.

SOUTHAMPTON.

(From our Own Correspondent.)

Messrs. Day, Summers & Co., Ltd., Northam Iron Works, completed two quick repair jobs to the p.s's. *Emperor of India* and *Lorna Doone* last month. Both vessels sustained damage to their paddle wheels, and both arrived in the yard within a day of each other, and the repairs were completed and the vessels sailed within four days. Both vessels are engaged in the excursion traffic, and a lengthy withdrawal would have involved serious loss.

Very extensive repairs and alterations were lately completed to the *Emperor of India*, which have had the effect of greatly increasing the popularity of the vessel.

The Red Star liner *Zeeland* has had a new hawse pipe casting supplied by the firm. The pipe weighed about six tons and the work was carried out in the short space of seven days from receipt of the pattern.

Mr. Alexander Macdonald's s.y. *Eothen*, 340 tons, underwent Lloyd's survey last month; also Mr. Mortimer Singer's s.y. *Maund* was dry docked and alterations to cabin work completed. Baron de Forrest's s.y. *Honor*, 1,020 tons, is due at the beginning of this month for docking and survey.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works, are now fitting out the large steam yacht for Lord Leith.

H.M.T.B.D. *Savage* is now completely plated and is fitting out. This is one of the new 27 knot destroyers.

H.M.T.B.D. *Nubian* has now completed her speed trials most satisfactorily.

An order has been received for four ferry steamers from the Port Commissioners of Calcutta. These steamers are to steam 12 knots and are similar to seven vessels supplied by this firm in 1906.

Repairs and overhauls have been carried out upon various troopships for Indian and Colonial service.

The R.M.S.P. Co.'s new **Intercolonial** steamer *Berbice* arrived here about the beginning of last month from the yard of Messrs. Harland & Wolff and proceeded into the inner dock.

A sister vessel is rapidly nearing completion by the same builders, and together these vessels will maintain a regular Intercolonial service in the West Indies in connection with the company's mail contract.

The New Wet Dock.—Good progress is being made with this, and the excavation is sufficiently advanced to convey to one's mind the great extent and depth of the dock. When completed, the dock will embrace an area of approximately 16½ acres and the depth of water will be 40 feet.

The Holland-America Liner "Rotterdam" was dry docked in the Trafalgar dry dock about the middle of last month. This is the second occasion on which this vessel has been docked at Southampton, and her immense size attracted considerable attention whilst she was on the blocks, and incidentally showed the necessity of a dock with much greater width for vessels such as the *Titanic* and *Olympic* now building at Messrs. Harland & Wolff's, as there was not much room to spare at the dock sides.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

THERE is a great amount of slackness in the shipbuilding departments and a large number of hands are being dispensed with. Apart from the second-class cruiser and the submarine shed there is nothing at all on the stocks and the sea side of the yard looks very empty indeed. Shortly Messrs. Vickers will be starting on the floating dock, which has been ordered by Aberdeen, and this will find some work, but fresh orders for ships are badly wanted. At the moment there does not seem to be anything shaping at all in regard to fresh orders. The shipbuilding industry generally is depressed and Barrow is feeling the pinch badly. It is too soon to talk about one of the "Contingent Dreadnoughts." That seems a certainty, but the order may not come for many months yet. Of course, there is the Argentine contract still to be placed, and Messrs. Vickers should stand a very good chance with their co-partners in this work, but there has practically nothing been said at all of this work—whether it is hanging fire, or whether Argentine are considering the different designs, is not known except to those interested, and they are not likely to allow anything to leak out. The work would be very welcome in Barrow. The inquiry for ocean-going passenger vessels is not brisk and the orders that are being placed are travelling along the old channels. It does seem strange that none of these orders come Barrow-wards. Certainly there is no firm more capable of dealing with this class of work. There is not a firm in the world that puts in better work than Messrs. Vickers, but, of course, that means a big price, and with this class of ship there are a large number of firms who specialize and the cutting is done very fine.

The ice-breaker *Earl Grey* is nearing completion. She presents a fine picture with her clipper stem, fine big two-pole masts, with plenty of rake, and a powerful funnel. Power it suggests, undoubtedly, although, of course, it is by no means to be accepted that because the funnel is big the power is likewise. There is one thing Messrs. Vickers excel in, and that is in the design of their funnels. They hit off the exact thing in every ship they build. They design the finest funnels of any shipbuilders I know. Many a vessel's appearance is marred by the putting in of a funnel which does not help the appearance of the ship. The *Earl Grey* should prove a great acquisition to the Dominion of Canada. Apart from her being used as an ice-breaker she will be much appreciated by the Government, either as the governor's yacht or when put on marine survey or fishery work.

The "Dreadnoughts."—The British battleship *Vanguard* is beginning to receive her gun mountings, and it will not be long before her guns are being put aboard. She has been placed in the inner berth again in order that the heavy weights can be placed in position. There is, of course, a great deal to do at this vessel, but work is proceeding apace and the number of men engaged upon her now must almost be a record one. There has been no hitch yet, and Messrs. Vickers are going to see that there is none. It will be a feather in the cap of this firm if they finish her and have her delivered within the contract time with a little to spare. There is nothing likely to have more weight with the Admiralty than this. The *Sao Paulo* does not show much development, but there is a lot of work going on aboard her and her gun positions are growing. The *Vanguard* should leave Barrow for the builders' steam trials about the end of October.

In connection with these two vessels one thing has become apparent. Two such battleships require a lot of attention from heavy-weight lifting cranes, and although there is a huge cantilever crane there, it is not sufficient. The idea of a floating crane similar to that on the Tyne is taking root, and it is now only a question of time. This class of crane can prove so handy in many ways. It can deal with vessels anywhere in the docks. For instance, a damaged battleship could be docked in the Ramsden dock basin, the floating crane could be brought alongside and any weight could be lifted. A firm like Messrs. Vickers are nothing if they are not up-to-date, and it would have been strange if they had not decided upon a crane of this sort. It seems a pity now that instead of building the second "hammer head" crane at the new wharf they did not build a floating crane, or even two. It would have saved a deal of trouble and money in the long run. The Tyne crane is fitted with propellers. It is not known whether the proposed Barrow one will, but it is almost sure, for a crane fitted with propellers, which could be used for slewing round or canting, is a great boon. Tugs are a nuisance on these occasions.

The question of dry dock accommodation for "Dreadnoughts" still stands in abeyance. This is another feature which is bound to be realized sooner or later. It will be a great expense, whether it is a dry dock or a floating pontoon. With reference to the latter there would be a difficulty about obtaining the depth. The docks would be difficult to dredge owing to the great boulders that are known to exist, and again, a depth of over fifty feet would have to be obtained. In my notes last month I erred in speaking of the depth. After discussing the idea with several people I am inclined to come back to the dry dock. Already there is a site marked out for it in a plan prepared by the local railway company.

Submarines.—Submarine construction continues to be brisk and "C's" are still being launched. The "D 1" has been put through a lot of trials and she seems to be shaping very well. It is generally a good sign when one sees the compasses being adjusted, and the "D 1" or "E 61" had hers seen to the other day. I hear that we are on the eve of important developments in regard to oil engines. What the improvements are it is difficult to say, but there is a rumour that it will revolutionise this branch of work and may mean a new industry.

Speaking of new industries brings me to what is now an undisputed fact. An airship is to be built at Barrow, and we have it on the authority of *The Morning Post* that the airship is to be of a rigid construction, and is for experimenting with by the Navy. Certain preparations are being made on the side of Cavendish Dock, which is a wide expanse of water some 120 acres in extent. This is called a dock, but really is only an enclosed sheet of water of varying depth. The shed which it is said is to be built there is to be a very long one, if the markings are anything to go by, and should be close upon 600 feet. I am told that this shed is to be no mere put-on, but is to be an iron-built one of substantial design. Piling in the dock is now going on, but sand having been found a delay is being caused.

The loss of "C 11," a Barrow-built submarine, and the subsequent attempts to salve her, again call attention to the great necessity there exists in this country for a vessel on the German principle for salving these boats. Here is a

power possessing over fifty submarines and not a vessel capable of lifting them, while Germany has now built and completed, some five years ago, a powerful vessel which is really two joined by great gantries, from which huge hoisting machinery is suspended. Really this country is frightfully old-womanish in many respects. A vessel of this class is an absolute and immediate necessity. Further than this we are sadly lacking floating dock facilities for submarine and torpedo craft. The latter were discussed some time ago, but the expense frightened the Admiralty at the time. It is a case of being penny wise and pound foolish. Besides it is terribly impracticable. It is also strange that no man in our Parliament has considered it his duty to urge upon the Government the absolute necessity of such vessels being built at once. The recent salvage attempts have made us look very little in the eyes of many other countries.

BELFAST.

(From our own Correspondent.)

At the time of writing the local shipyards and engine works are shut down for the July holidays. The day prior to closing (8th July) was a busy one, there being three trial trips and one launch.

Messrs. Harland & Wolff.—The launch referred to took place from the south end of the Queen's Island, the new steamer being the steamship *Meltonian*, which Messrs. Harland & Wolff have built to the order of the Leyland line. The *Meltonian* is a sister ship of the *Median*, *Memphian* and *Mercian*, previously constructed by the same builders for the Leyland line. She will be fitted with quadruple-expansion engines and all the latest and most approved auxiliary machinery. Upon the same day as that of the launch Messrs. Harland & Wolff completed and sent to sea two twin-screw steamers—the *Karoola* and the *Berbice*. The former vessel was built to the order of Messrs. Ilwraith, McEacharn and Co., Ltd., and has been specially designed for the owners' trade round the Australian coast. The two big White Star liners are beginning to take shape on the north end of the yard, but the south end now presents a more bare appearance than it has done for some years past.

Messrs. Workman, Clark & Co.—Upon the day before the holidays this firm had a highly successful trial of the steamer *Atenas*, which is the ninth vessel built by them for the Tropical Fruit Steamship Co., Ltd. She is 394 ft. long with a gross tonnage of 5000, and has accommodation for 100 first-class passengers. She is propelled by a set of triple-expansion engines steam being supplied by five single-ended boilers working under an improved system of forced draught. During the month Messrs. Workman, Clark & Co. have completed the first of their Orient liners—the *Otranto*—and have launched the *Orvieto*, which is the second of this pair of magnificent vessels. These are undoubtedly the finest steamers yet turned out by this firm, and it is highly satisfactory to note that the series of trials carried out on the former were successful in every respect, a mean speed of 19 knots having been obtained on the full-power trials. It is not necessary to give here full particulars of these vessels, readers of the Marine Engineer being already familiar with the description of these and their sister ships built on the Clyde.

Messrs. MacColl & Co.—The Wigan Coal and Iron Co.'s new steamer *Balniel*, for which this firm is constructing the machinery, was launched by the Dublin Dockyard Co. on the 17th July. In due course the vessel will be towed to Belfast to receive her engines and boilers. She is intended for the company's coal trade between Garston and Belfast. Since last month's notes were printed Messrs. MacColl & Co. have completed the repairs to the steamer *Heathfield*, referred to in a previous issue.

"Lusitania."—The *Lusitania's* two rearmost propellers have now been made three-bladed, while the other two are of the four-bladed solid type. This pattern and arrangement of propellers have proved eminently successful in the *Mauretania*, and the hope is entertained that similar benefit will accrue to the *Lusitania* as a result of the change.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Bismarck.—On May 20th, Messrs. Ropner & Sons, Ltd., of Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*:—Length, 378 ft. 6 in.; breadth, 53 ft.; depth, 27 ft. 3 in. The vessel is built to the highest class in the British Corporation Registry to carry about 7,900 tons. She is for foreign account, and is fitted with the builder's patent improved trunk deck with two large clear holds, and only two large hatchways, one being 82 ft. long by 26 ft. wide, and the other 67 ft. long by 26 ft. wide, thus facilitating rapid loading and discharging. The vessel is built on the deep frame principle, the frames being of bulb-angle steel, and the holds are clear of all obstructions to the stowage of cargo, there being no hold beams or wide stringers. She has capacity for about 1,500 tons of water ballast in her cellular bottom and peak tanks. Her measurement capacity is exceptionally large and she is fitted with nine powerful steam winches working in conjunction with ten derricks post arranged in pairs, with wire runners and purchase spans. Steam is supplied to the deck machinery by a large horizontal multitubular boiler 11 ft. by 10 ft. The engines are of the triple-expansion type by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, of about 1,800 I.H.P. on a very full specification, with boilers 16 ft. 9 in. by 11 ft. 6 in., working at a pressure of 180 lbs. Messrs. Wailes, Dove and Co.'s "Bitumastic" enamel was applied to the bunkers and their "Bitumastic" covering to the tank tops under engines and boilers.

Alfred Kreglinger.—On May 21st, Messrs. Osbourne, Graham & Co. launched from their yard at Hylton the s.s. *Alfred Kreglinger*, which they have specially constructed to the order of Messrs. Furness, Withy & Co., Ltd., of West Hartlepool, for the Belgium-Scandinavian Steamship Co., of Antwerp. The vessel is built on the raised quarter-deck principle, having bridge amidships for accommodation. She is 218 ft. in length and carries 1,550 tons on a light draught. The steamer is arranged as a self-trimmer, and is classed under special survey with the British Corporation. Water ballast is in the double bottom and after peak. The deck machinery is of the most modern description. The vessel is a further addition to the already large fleet of colliers, which the owners have running in the Continental and British coasting trade. Engines are by Messrs. Richardsons, Westgarth & Co., Ltd., of Sunderland, having cylinders 16 in., 27 in., 44 in. by 30 in., and one large boiler 180 lbs. pressure. A Cochran (Anna 1) donkey boiler with patent seamless furnace has been supplied and fitted.

Ethrope.—On May 27th, there was launched from the yard of Messrs. The Lytham Shipbuilding and Engineering Co., Ltd., a handsome twin-screw launch to the order of Messrs. Miller Bros. (of Liverpool), Ltd., for use in West Africa. She is fitted with machinery by the shipbuilders and has teak house and accommodation on deck as well as crew's quarters and cargo space under deck, and is provided all fore and aft with a sun deck. The vessel's principal dimensions are 64 ft. by 13 ft., and she carries a cargo and bunkers on a draught of 3 ft. 6 in., and is also fitted with towing gear for use when required. The vessel has been built under the superintendence of Messrs. Flannery, Baggallay & Johnson, of London, Liverpool and Rotterdam.

British Sun.—On June 3rd, a large company assembled at the Wallsend Shipyard of Messrs. Swan, Hunter and Wigham Richardson, Ltd., to witness the launch of a finely modelled three-deck steamer for carrying petroleum in bulk. She has the following dimensions:—Length overall, 414 ft.; 52 ft. 3 in. breadth extreme, and a moulded depth of 31 ft., and will carry about 8,150 tons deadweight on a light draught. The propelling machinery, which is being constructed by the Wallsend Slipway and Engineering Co., Ltd., consists of a set of triple-expansion engines, with cylinders 27 in., 45 in. and 75 in. diameter, by 48 in. stroke and three single-ended boilers working at a pressure of 180 lbs. per square in. The vessel is built to Lloyd's highest class and under the superintendence of Mr. Oliver Duke. On leaving the ways she was gracefully named the *British Sun* by Mrs. William Smellie, of Liverpool.

LAUNCHES—Scotch.

H. C. Henry.—On June 8th, Messrs. The Greenock and Grangemouth Dockyard Co., Ltd., launched from their yard at Greenock the oil-tank steamer *H. C. Henry*. The vessel is 373 ft. long, 49 ft. beam and 29 ft. 3 ins. moulded depth. She is constructed to carry about 6,000 tons on a light draught and is ordered by Messrs. John Black & Co., West George Street, Glasgow, on behalf of Mr. Rood, of Seattle, and is being built under the supervision of Messrs. Flannery, Baggallay & Johnson, of London, Liverpool and Rotterdam, to have the highest class at Lloyd's, and to conform with the Suez Canal Regulations for carriage of petroleum in bulk. The machinery is being supplied by Messrs. David Rowan and Co., of Glasgow, the engines having cylinders 25 in., 41 in. and 68 in. in diameter, with a stroke of 48 in. Steam is being supplied by three large main boilers with 180 lbs. pressure. There is a large auxiliary boiler, a powerful windlass, and the vessel will be up-to-date in all respects with a view to the rapid handling of general cargo. Vessel is also fitted with a complete electric light installation and special heating arrangements for carrying creosote in bulk.

Sand Grouse.—On June 8th, Messrs. Wm. Simons & Co., Ltd., Renfrew, launched, complete and ready for work, the twin-screw suction hopper dredger *Sand Grouse*, which they have constructed to the order of the Crown Agents for the Colonies on account of the Government of Southern Nigeria. The new dredger, although of larger dimensions and of much greater carrying capacity than the *Egerton*, is fitted with practically the same pumping outfit. The suction pump is driven from a set of triple-expansion surface-condensing engines and is capable of dredging sand at the rate of 2,500 tons per hour from a depth of thirty-five feet below water level. The main suction pipe is led through a central bow well and is controlled by hydraulic gear. This pipe is connected to the suction pump and is fitted with an arrangement of flexible joints for preventing damage when the dredger is working on an exposed bar, the lower end of the pipe being so arranged that the vessel can plunge about without disturbing the nozzle on the ground. The hopper is fitted with the builders' patented combination of discharge valves and special keelsons, whereby the load may be discharged either through the bottom by means of the valves or overside by the discharge keelsons for land reclamation. The dredger will be propelled at 10 knots speed by two sets of triple-expansion engines fitted with the most modern appliances for efficiency and economy. Steam is supplied from three steel boilers of the Scotch type, constructed for a working pressure of 180 lbs. per square inch. The total power of the propelling and pumping engines and auxiliary engines on board is about 3,500 I.H.P. Very powerful windlasses are fitted at bow and stern and powerful capstans are placed aft for manœuvring purposes. A steam derrick crane is provided on deck for general service purposes. Spacious and well-ventilated accommodation suitable for a hot climate is provided on upper deck for the officers and engineers. Steam steering gear, electric light installation and all the latest appliances and improvements for this type of vessel are fitted on board.

Oranje Nassau.—On July 3rd, the Fairfield Shipbuilding Co., Govan, launched the twin-screw steamer *Oranje Nassau*, the second of three vessels they are building for the Zeeland Steamship Co., of Flushing. The *Oranje Nassau*, like her sister ships, is intended for the night service between Flushing and Queenborough, and is 563 ft. in length overall, 45 ft. 4 in. in extreme breadth, 25 ft. 10 in. in depth to upper deck, and of about 3000 tons gross. There are five decks. Two funnels, with a fore and aft rig, give the vessel a smart appearance. Special features are the large number of one-berth cabins, and the provision of submarine signalling and wireless telegraphy apparatus. The dining saloon has seating accommodation for ninety-three persons. Of the 246 first-class passengers sixty will have single-berth cabins, and the majority of the others two-berth. After there are berths for 110 second-class passengers. The propelling machinery consists of two sets of triple-expansion engines.

Henzada.—On July 7th, Messrs. William Denny and Brothers Dumbarton, launched the steel screw steamer *Henzada*, built for Messrs. P. Henderson & Co.'s Glasgow and Rangoon service. The *Henzada*, like the other vessels of the company's fleet, has been built to the British Corporation's classification. Her principal dimensions are:—Length, 430 ft.; breadth, 52 ft. 9 in.; depth, 31 ft. 1½ in. She will have superior accommodation for passengers, and special care will be taken with the ventilation of this accommodation, an installation of electric fans being fitted in all the public rooms and in each state-room so as to entirely neutralize the heat experienced in the passage through the Red Sea. In order to facilitate the stowage of bulky cargo the hold pillaring has been arranged on the "built pillar and girder" principle, which does away with the closely spaced round stanchions, thus leaving large, roomy holds. The vessel will have thirteen derricks, all having an outreach of fully 8 ft. over the side, the lifts ranging up to 30 tons, so that cargo of practically any weight or bulk may be conveniently handled. The propelling machinery will be supplied by Messrs. Denny & Co.

Winchester.—On July 14th, there was launched at Scotstoun a steam yacht named *Winchester*. The vessel has a length of 165 ft. over all, her breadth moulded is 15 ft. 6 in., her depth amidships 9 ft. 9 in., and her displacement about 180 tons. She will be propelled by Parsons turbines of 2400 horse power, fitted on three shafts. Steam is supplied from two water-tube boilers constructed for burning oil fuel exclusively, tanks for the fuel being arranged at each end of the machinery space. The vessel is expected to attain a very high speed.

Itapema.—On July 15th, the Ailsa Shipbuilding Co., Ltd., launched from their Troon Shipyard a twin-screw passenger steamer to the order of Messrs. Cia. Nacional de Nav Costeira, Rio de Janeiro. The vessel, which is a sister ship to the t.s.s. *Itapuca*, launched by the Ailsa Company this year, is to Lloyd's A1 class for Brazilian coasting trade, and is of the following dimensions:—270 ft. B.P. by 42 ft. beam by 18 ft. 6 in. moulded. Accommodation has been provided for sixty-six first-class and for fifty steerage passengers. The vessel is equipped with all modern conveniences as is usual in modern vessels. The electric light installation is provided for by Messrs. Claude Hamilton, Ltd. The refrigerating plant by Messrs. J. & E. Hall, Ltd., fire-extinguishing plant by Messrs. Clayton Fire Extinguishing and Ventilating Co., Ltd. Four hydraulic cranes by Messrs. Brown Bros., are fitted for the speedy handling of cargo. The carrying of fruit being a feature of the trade for which the vessel is intended, a compartment has been set aside for the purpose. When fully laden the vessel is expected to attain a speed of 12 knots per hour, and will be fitted with two sets of triple-expansion engines by the builders. Messrs. Wailes, Dove & Co.'s "Bitumastic" cement was applied to the bottom fore and aft and their "Bitumastic" enamel to the floors fore and aft, bunkers and peaks.

LAUNCHES—Irish.

Orvieto.—On July 6th, Messrs. Workman, Clark & Co., Ltd., Belfast, successfully launched from their North Yard their second contribution to the five new steamers which the Orient Line are adding to their fleet to meet the requirements of their new mail contract with the Australian Commonwealth. The *Orvieto* is the sister ship to the *Otranto*, whose speed trials on the Clyde last week were so eminently successful. She is a beautifully modelled vessel 554 ft. in length with a gross tonnage of about 12,500, and has been constructed under special survey for the highest class in Lloyd's Registry besides fulfilling the requirements of the British Board of Trade and the Commonwealth Navigation Act. Accommodation of a superior description has been provided for over 450 first and second-class passengers, and about 850 third-class and emigrants. The state-rooms for each class are airy and comfortable, and include special suites of rooms in the first-class accommodation. Having regard to the fact that the vessel will be trading in both cold and hot climates special arrangements have been made for the comfort of passengers under all conditions by the installation of a thorough system of steam heating throughout the passenger and crew accommodation, while the matter of efficient ventilation has received most careful consideration, and is further improved by the provision of electrically-driven fans in all the public rooms and state-rooms. The cargo space

is divided into five spacious holds, three of which have been insulated and prepared for the carriage of meat and fruit cargoes in bulk. An extensive plant of refrigerating machinery has been installed in conjunction with the insulated holds, by means of which perishable cargoes brought from the colonies will be preserved in good marketable condition. Steam cranes, steam winches, derricks and other cargo gear of the most improved description have been installed for the expeditious handling of cargo. The propelling machinery consists of two independent sets of quadruple-expansion engines, carefully balanced so as to do away with vibration as far as possible. The auxiliary machinery throughout is of the most modern type. The boiler-room installation includes four double-ended and two single-ended steel boilers arranged in two compartments and working under an improved system of forced draught.

Meltonian.—On July 8th, Messrs. Harland & Wolff, Ltd., launched from their South Yard the steel screw steamer *Meltonian* for the Wilson's and Furness-Leyland Line, Ltd. The *Meltonian* is a sister ship of the *Median*, *Memphian* and *Mercian*, constructed by the same builders. The vessel has been built under Board of Trade survey for passenger certificate. She will have quadruple-expansion engines, an installation of electric light, as well as the latest and most improved facilities for working ship and cargo.

TRIAL TRIPS.

May Scott.—On June 1st, the screw steamer *May Scott*, particulars of which are given in our list of launches, built by the Blyth Shipbuilding & Dry Docks Company, Limited, for Messrs. the Hay, Scott Steamship Company, Limited, was taken to sea for trial. Triple-expansion engines of good power have been fitted by Messrs. North-Eastern Marine Engineering Co., Ltd., Wallsend, cylinders 19 in., 31 in. and 51 in. by 36 in. stroke, working at 180 lbs. pressure. The representatives of owners, builders and engineers on board were highly satisfied with the performance of both ship and machinery, good results being obtained. The hull and machinery have been built under the supervision of Mr. Norman Burnett, of Newcastle-on-Tyne. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Asiana.—On June 5th, the handsome steel screw steamer *Asiana* left the West Hartlepool docks to undergo her official trial trip in Hartlepool Bay. Particulars of the boat will be found in our list of launches. The engines worked exceedingly well throughout the trials, the vessel maintaining a speed of 11½ knots, and have been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, the sizes of the cylinders being 23½ in., 38 in., 64 in. by 42 in. stroke, with two large single-ended boilers working at a pressure of 180 lbs. per square inch. The vessel afterwards proceeded to Fowey to load.

Paulina.—On Saturday, June 12th, the steamer *Paulina* (particulars of which will be found in our launches, May issue), built by Sir Raylton Dixon & Co., Ltd., of Cleveland dockyards, Middlesbrough, and constructed on their patent cantilever frame system with topside water-ballast tanks, to the order of Messrs. Modesto Pineiro & Co., of Santander, Spain, to meet the very special requirements of her owners' iron ore-carrying trade from Santander to Glasgow, proceeded to sea to undergo her loaded trials. After the trials, which passed off most successfully, the vessel proceeded on her maiden voyage under the command of Captain Valentin Ontanon. The arrangement of this steamer has been designed in collaboration with her builders, by Mr. Fred Edwards, M.I.N.A., of 62, Bishopsgate Street Within, London, who has specially supervised the building along with his assistant, Mr. T. H. Tunstall.

Clearfield.—On June 14th, the new large oil-tank steamer *Clearfield*, built by the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, was taken to sea for her trial trip, after which she disembarked her passengers and proceeded straight on her voyage to New York. This vessel, which is over 360 ft. long by 48 ft. 6 in. beam and 30 ft. 6 in. moulded depth, has been constructed to the Bureau Veritas highest class for carrying oil in bulk. The vessel will carry nearly 6,500 tons deadweight, and has twenty-eight separate oil-tight compartments, the whole of which were completely tested in nine working days. The oil installation consists of three specially designed oil pumps arranged to pump through a double line of oil piping. The accommodation of the vessel is very handsomely fitted up, the saloon being in polished wainscot oak and the charthouse and lobbies in polished mahogany. The machinery, which has been supplied by The Wallsend Slipway & Engineering Co., Ltd., consists of engines 26 in., 43 in. and 70 in. by 48 in. stroke, with three single-ended boilers, and on trial they enabled the vessel to attain a speed of over 11½ knots during a series of runs over the measured mile.

Golden Eagle.—The paddle steamer *Golden Eagle*, which has been constructed by Messrs. John Brown & Co., Ltd., Clydebank, for the General Steam Navigation Company, has just carried out her official trials on the Firth of Clyde. The ship, as well as her machinery and equipment, will be the most complete and up-to-date production of her type sailing on the Thames. She is 275 ft. long, 32 ft. beam and 10 ft. 0 in. in depth. Of about 000 tons gross, she has been built to Lloyd's classification and to the requirements of the Board of Trade for carrying passengers in the English Channel and to Boulogne. Her engines are of the triple-expansion diagonal type, the high-pressure cylinder being 30½ in. in diameter, the intermediate-pressure 46½ in., and the low-pressure 71 in., with a stroke of 5 ft. The funnel, being oval in section, gives a powerful appearance to the ship. It is fitted with a spark arrester at the base, and a noticeable feature of the trials was the total absence of the cinders, which in many ships of this type cause so much annoyance to passengers on deck. The trial specified by the owners was to consist of six hours' continuous steaming at full speed, with a load on board representing the average working conditions of the vessel. This was successfully carried out. The vessel was first run on the measured mile at Skelmorlie, the mean speed attained being 19·2 knots. She then proceeded down the Firth, maintaining this speed.

San Antonio.—On June 10th, the *San Antonio*, a steel-screw tank steamer, which has been built by Messrs. Swan, Hunter and Wigham Richardson, Ltd., Wallsend-on-Tyne, for Messrs. S. Pearson & Son, Ltd., Westminster, London, for the carriage of petroleum and benzine in bulk, was taken out to sea for her trial trip. The vessel is of the following dimensions:—Length over all, 403 ft.; breadth extreme, 50 ft. 6 in.; and depth moulded, 32 ft. She is built to Lloyd's highest class for three-deck rule, and carries 7,700 tons of oil and bunkers on a moderate draught. The propelling machinery, which has been built by the North-Eastern Marine Engineering Co., Ltd., Wallsend, consists of a set of triple-expansion engines, with cylinders 26 in., 43 in. and 72 in. in diameter by 48 in. stroke, with three boilers working at a pressure of 180 lbs. per square inch. On the trial run the vessel attained a speed of over 11 knots per hour on the measured mile.

Alfred Kreglinger.—On July 7th, the new self-trimming collier, specially built by Messrs. Osborne, Graham & Co. to the order of Mr. Harry E. Christensen, Manager to the Belgian Scandinavian Steamship Co., Ltd., of Antwerp, through Messrs. Furness Withy & Co. Ltd., made her official trial trip. There was a large company present, and the trial proved in every way satisfactory, a speed of 10½ knots being easily attained.

H. C. Henry.—The oil tank steamer *H. C. Henry*, which has been built by the Greenock & Grangemouth Dockyard Co., Ltd., was taken on her trial trip at load draft on the 3rd inst., when the guaranteed speed was exceeded.

Otranto.—On June 20th, the new twin-screw steamer built by Messrs. Workman, Clark & Co., Ltd., Belfast, left the Alexandra Wharf, early, and after adjustment of compasses in the Lough proceeded to the Clyde for her speed trials. The *Otranto* is the first of two vessels being built by Messrs. Workman Clark & Co., Ltd., for the Orient Steam Navigation Company. A series of trials were conducted on the Firth of Clyde, all of which were eminently satisfactory, the mean speed attained being 18·05 knots.

Tynemouth.—On July 17th, the fine new steel screw steamer, built by Messrs. Wood Skinner & Co., Ltd., of Bill Quay-on-Tyne, to the order of Messrs. The Burnett

S. S. Co. Ltd., of Newcastle, left the Tyne for her official trial trip. During the trial run the machinery worked without a hitch, and easily maintained a speed of over 11½ knots, giving complete satisfaction to all concerned. Amongst those present were Mr. Walter Burnett representing the owners, Mr. Norman Burnett, under whose supervision both hull and machinery have been constructed, Mr. Jas. Skinner and Mr. L. Skinner, representing the shipbuilders, and Mr. J. Daglish representing the engine builders.

Karoola.—On July 8th, the twin-screw passenger and cargo steamer *Karoola*, built by Messrs. Harland & Wolff, Ltd., to the order of Messrs. McIlwraith, McEacharn & Co. Proprietary Ltd., of London and Melbourne, left the builders' works at Belfast, and after adjustment of compasses and a satisfactory trial trip, proceeded to Glasgow, whence she will sail for Melbourne at the end of the month.

Thessaly.—On June 23rd, the new steel shelter-deck steamer *Thessaly*, was taken to sea for her trial trip, after shipping about 700 tons of bunkers at the Stockton Corporation Wharf. As soon as compasses were adjusted a ten-mile course was run with and against the tide, when the vessel attained a mean speed of 13 knots. The behaviour of ship and machinery was entirely satisfactory, and it was noticeable that there was a marked absence of vibration in any part of the vessel, this being one of the advantages claimed to be due to the system of construction. Vessel left the Tees Bay at 1.45 p.m. for Liverpool, whence she is due to sail in Messrs. David MacIver & Co.'s River Plate line on July 3rd.

Caterino.—On June 22nd, the handsome steel screw steamer, built by Messrs. W. Gray & Co., Ltd., West Hartlepool, for Messrs. Furness, Withy & Co., Ltd., of West Hartlepool, was taken for her trial trip. The trial was satisfactory in all respects, a mean speed of 10½ knots beeng obtained. Captain W. Brackenbury and Mr. T. Tose represented the owners, Captain Evans being in command; the shipbuilders and enginebuilders were represented by Captain J. E. Murrell and Mr. Maurice S. Gibb, and the British Corporation by Mr. A. F. J. Macdonald. After the trial the vessel proceeded to Archangel to load.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C denotes First Class, 2C Second Class.

June 12th, 1909.

Adam, J. D .. 1C London
Atkin, B ...... 2C Liverpool
Austin, J .... 2C Greenock
Bailey, T A L 2C Liverpool
Barnes, H T .. 2C London
Braid, R H .. 1C Dundee
Cubbin, W G 1C Liverpool
Dowson, E..... 1C N Shields
Drummond, T P 1C London
Ferguson, P .. 1C Greenock
Gillett, W J .. 2C London
Guild, D ...... 2C Dundee
Guthrie, N .... 1C London
Howlett, J .... 2C Liverpool
King, P. R .... 2C London
Kinloch, G .... 1C Greenock
Kirkland, J .... 1C Liverpool
Linn, W. ...... 1C Greenock
Mackenzie, T G 2C Liverpool
Meggitt, A H... 1C Liverpool
Newlands, J .. 2C Greenock
O'Kane, W J. 2C Liverpool
Peters, J ...... 2C Greenock
Pook, W F. .. 1C London
Rae, A H .... 2C Greenock
Rankin, C W .. 1C Liverpool
Shaw, J. ...... 2C Greenock
Smethurst, M .. 1C Hull
Stephenson, J E 2C N Shields
Wilson, G. .... 2C Greenock

June 19th

Alexander, J. F 2C Glasgow
Aris, G. F. .... 1C Liverpool
Armstrong, T... 2C N Shields
Beardwell, J J. 1C N Shields
Bernard, T..... 1C Glasgow
Besant, W P .. 1C South'ton
Bowen, E. M .. 2C Cardiff
Boyd, F. C..... 2C Cardiff
Burt, T M..... 2C Leith
Cain, B ...... 1C Liverpool
Carter, H R... 2C Liverpool
Chipchase, R H 1C W Hart'l
Chisholm, H .. 1C Glasgow
Claireaux, J T 1C Leith
Coates, S .... 2C London
Crawford, C W 2C Cardiff
Davidson, J .. 2C W Hart'l
Dickson, W. .. 1C Glasgow
Dodds, —...... 2C Glasgow
Ferguson, W .. 2C Glasgow
Flucker, T. C... 1C Leith
Fraser, G....... 1C Barrow
Fry, F. H. .... 2C Cardiff
Geddes, J. T .. 2C Leith
Gibson, S M .. 1C Glasgow
Glover, C .... 2C W Hart'l
Goudie, F R... 1C London
Goodman, R. G 2C London
Grant, A ...... 1C London
Gray, R. ...... 2C Glasgow
Hayes, J H .. 2C Liverpool
Hill, T H .... 2C W Hart'l
Hill, W C .... 2C Glasgow
Horn, D G .. 1C Leith
Keens, A ...... 2C W Hart'l
Knapp, O. R. .. 1C Cardiff
Lewis, J ...... 1C W Hart'l
Lewthwaite, J... 1C Cardiff
M'Lean, H..... 1C Glasgow
M'Pherson, A... 1C Glasgow
Mason, C H... 2C N Shields
Mehaffey, J..... 2C Barrow
O'Connell, M T. 2C London
Oliver, A T. .. 1C W Hart'l
Ord, D W..... 1C N.Shields
Ostens, A. .... 1C N.Shields
Parnis, C. .... 2C N.Shields
Parry, E. H .. 2C Liverpool
Paton, H....... 2C Liverpool
Perritt, A E .. 1C W Hart'l
Potter, B ...... 2C London
Reekie, J ...... 2C Leith
Reid, M. ...... 2C Glasgow
Retchell, H V. 2C Cardiff
Rose, M ...... 1C Glasgow
Sellers, H. .... 1C Barrow
Sharp, A D. .. 2C N Shields
Stephens, E. R. 1C South'ton
Thomas, T. H. 2C London
Wallis, T A. .. 1C Barrow
Waugh, A .... 2C Shields
Weir, A P .... 1C Cardiff
White, J. W .. 1C Glasgow
Williams, J K... 1C Glasgow
Wilson, H R .. 2C Glasgow
Wilson, R. P... 2C Leith
Wright, M. .... 1C Glasgow
Young, J ...... 2C Glasgow

June 26th.

Adamson, W. 2C Aberdeen
Anderson, E. .. 2C Hull
Archbold, F. G. 1C N Shields
Blackburn, R S. 1C L'nderry
Brook, J. A .... 1C Aberdeen
Brown, G. W... 2C N Shields
Christie, A .... 1C Aberdeen
Curr, T ...... 1C London
Currie, A W .. 2C London
Durrant, A G. 1C N Shields
Elsdon, J W .. 2C N Shields
Esson, J R .... 2C Aberdeen
French, G G H 2C Greenock
Gordon, W. G. 2C N Shields
Gray, G S .. 2C N Shields
Grimmett, S J. 2C London
Hardie, J. .... 1C Aberdeen
Henderson, F. N. 2C Greenock
Hilling, F. .... 2C Hull
Johnson, R. W. 1C N Shields
Kendall, K. .... 1C Hull
Lamb, A....... 2C Aberdeen
Lord, C ...... 2C N Shields
Macdonald, E... 2C London
Macfarlane, T T. 1C Greenock
M'Kenzie, D... 1C Greenock
M'Millan, J H 2C Greenock
Marrs, H .... 2C L'nderry
Mead, F W. .. 2C Bristol
Millburn, W .. 2C Greenock
Milne, A C. .. 2C Aberdeen
Nimmo, G W 1C N Shields
Parker, T .... 2C Sunderl'd
Quarmby, R. A 1C Hull
Russell, J. C G 2C London
Sandilands, D 2C Greenock
Seubert, C W. 1C London
Smith, P. W. .. 1C London
Thomson, J B 1C Aberdeen
Tilley, L ...... 2C London
Watson, W L. 1C Hull
Whyte, A W .. 1C Aberdeen

July 2nd

Barr, A ...... 2C Belfast
Brown, J ...... 2C South'ton
Childs, C S .. 1C Glasgow
Cloudsley, J. A 2C Glasgow
Corbett, D .... 1C London
Court, A. F. .. 2C Liverpool
Crawford, D M 1C Glasgow
Duckett, F E .. 1C London
Gammon, R G 1C London
Greenal, F .... 2C London
Gunn, W. .... 1C Glasgow
Hall, J W .... 1C Glasgow
Hay, R. W..... 2C Leith
Hughes, W. A. 1C Cardiff
Hunt, W F. .. 1C Liverpool
Inskeep, J B. .. 1C Liverpool
Jenkins, H .... 2C Cardiff
Jones, W T. .. 1C Glasgow
Kelso, J. N .. 2C London
Kennedy, W. .. 2C Belfast
Kent, J. F. . .. 2C Cardiff
Kjode, J. ...... 2C London
Lawrence, H P. 1C Cardiff
Loftus, S R. .. 1C Belfast
M'Clelland, H 2C Belfast
McIntosh, A. H 2C Leith
Mackenzie, J .. 1C London
McMaster, T W. 1C Glasgow
Mailer, J....... 2C Glasgow
Mitchell, F..... 2C Leith
Murphy, A..... 2C Belfast
Purvess, J M 2C Liverpool
Quigley, R..... 2C Glasgow
Randow (von) H 1C London
Ritchie, W W. 1C Glasgow
Robinson, J. T. 2C Belfast
Scott, J ...... 1C Belfast
Scott, M ...... 2C Leith
Sinclair, W D. 1C Leith
Sinnet, W. J. .. 1C Liverpool
Smith, A ...... 2C Glasgow
Trenchard, I .. 1C Cardiff
Wallace, D C. 2C Leith
White, W. H... 2C London
Williams, W. T 2C Cardiff

July 9th.

Batley, F ...... 2C N Shie'ds
Bennett, R .... 2C London
Bowman, J J... 2C N Shields
Cameron, T .. 1C Liverpool
Clarke, B C .. 2C Liverpool
Curtis, H A 1C London
Danieils, W W 2C London
Davies, J A .. 2C London
Devonport, W. 2C N Shields
Dickson, G E. 1C N Shields
Ditty, T ...... 2C Liverpool
Donkin, A .. 2C N.Shields
Emery, T. .... 1C Liverpool
Foster, A R .. 1C N Shields
Gibson, C D .. 2C Liverpool
Harold, C F .. 1C N.Shields
Harvey, T .... 1C Liverpool
Hedworth, C .. 1C N Shields
Holme, G .... 1C Liverpool
Jack, T J. .... 1C Liverpool
Johnstone, A T. 2C Liverpool
Jones, R P .. 2C Liverpool
Kelly, W J .. 2C Liverpool
Lamplough, H E 1C N Shields
Lawson, F. .... 2C N Shields
Monk, A V .. 2C London
Mortleman, G 1C London
Nichol, W. J .. 2C N.Shields
Pearce, E. .... 2C London
Peterson, A..... 2C N Shields
Russell, R .... 1C London
Shrouder, F N 1C Liverpool
Shrubsall, W .. 2C London
Thompson, W 2C Liverpool
Thomson, T A S 1C N Shields
Todd, P. J .... 1C N Shields
Townsend, J O. 2C N Shields
Werpe (De), A F 2C N Shields
White, F E .. 1C N Shields
White, T Y .. 1C N.Shields

The Marine Engineer

And Naval Architect.

LONDON, SEPTEMBER 1st, 1909.

COMBINATION ENGINES.

A VERY interesting paper on the trials and performances of s.s. *Otaki* was read by Engineer-Commander W. McK. Wisnom, R.N., at the Joint Summer Meeting of the Institution of Engineers and Shipbuilders in Scotland and the North-East Coast Institution of Engineers and Shipbuilders, held at Glasgow in the early part of last month. People interested in the economics of steamship propulsion have awaited with much interest the publication of the actual working results of the s.s. *Otaki*, which, as our readers may remember, is the first merchant vessel fitted with a combination of reciprocating and turbine machinery. Although the particulars given are not nearly as full as could be wished for, still we think the engineering world is much indebted to the shipbuilders, Messrs. Denny & Co., of Dumbarton, and to the owners, the New Zealand Shipping Co., for their generosity in placing the public so early in possession of such information on this particular subject as they have thought desirable. The results given are in comparison with those obtained on the two sister ships, *Orari* and *Opawa*, built by the same firm in 1906. The three ships are identical, with the exception that the *Otaki* was made 4 feet 6 inches longer to make up for loss in cargo capacity, due to there being three shafts instead of two as in the earlier boats, and that the design of the stern and stern-post was modified to provide for the three propellers instead of two. The boiler installation was identical in each case and was fitted with Howden's forced draught. The cylinders of the *Orari* and *Opawa* were $24\frac{1}{2}$ ins., $41\frac{1}{4}$ ins. and 69 ins. with a 4-ft. stroke, while those of the reciprocating engines of the *Otaki* were $24\frac{1}{2}$ ins., 39 ins. and 58 ins. with a 39-inch stroke. The rotor drum of the turbine was 7 ft. 6 ins. in diameter. The difficulty of fixing on a reliable basis of comparison, owing to the distinction between indicated horse power and shaft horse power as applied to the reciprocating and turbine engines respectively, was dealt with by taking the water consumption per E.H.P. as the factor for comparison, as it is obvious that in sister vessels with similar boiler installations the coal consumption per mile or per hour at the same speed affords the best comparison of the two systems. It was deduced that a water consumption of 21·9 lbs per E.H.P. per hour in the *Otaki* corresponded to 27·5 lbs. in the *Orari*, the gain on this basis being therefore 20 per cent. What will, however, interest the shipowner most is the comparison of the coal consumption of the three vessels. For instance, from Liverpool to Teneriffe the *Otaki* burnt 11 per cent. less coal than the mean consumption of the other two ships under similar conditions and at practically the same speed, and taking the consumption for the round voyage to New Zealand and home the saving would be 500 tons for the *Otaki*, which is about 8 per cent. of the total consumption. As the vessels are coaled for the outward voyage only, this would mean that 250 tons extra of cargo could be taken by the *Otaki*. The author points out that the 8 per cent. may appear disappointing in comparison with the 11 per cent. gained out to Teneriffe, but the comparison is unsound, as there were various adverse circumstances to account for the falling off; for example, on being docked the ship was found to have an abnormally foul bottom. Assuming the saving to have been made as stated and that a larger saving will be effected in the future, does it not seem that the boiler installation of the *Otaki* is larger by about 10 to 12 per cent. than is necessary, and thus not only can bunker space be saved, but also boiler-room space and the cargo space be increased accordingly? Further, as the machinery weight of the *Otaki* is 30 tons, or 3·25 per cent., in excess of the sister ships, it is not unreasonable to assume that this factor can be reduced at the same time. While recognising that considerable difficulties must have been experienced in collecting the necessary data on which the results have been deduced as set out in the paper, and that further investigation may possibly throw a somewhat different complexion on the subject, we think that the New Zealand Shipping Co. is to be heartily congratulated for the courage shown in allowing the experiment to be made, and for the public spirit exhibited in permitting the publication of the results. In conclusion, we must express our disappointment at the meagreness and apparent uselessness of the discussion on the paper read, judging from the published reports, as one was led to think that the subject would draw strong views, probably from both points of view, but particularly from those engineers who are strongly opposed to the combined system. However, in the near future, when more concrete figures can be presented, we may obtain a comprehensive and valuable discussion which will bring out the merits and demerits of both systems in strong relief.

Just before going to press, we have received the information which is contained in the appendix of Commander Wisnom's paper, stating that since the paper was written, the *Otaki* has made another round trip, but at a greater speed than her sister ships have attained under similar conditions. This difference in speed makes it difficult to form a sound comparative estimate, but it is considered that, having regard to all the circumstances, the saving in coal by the *Otaki* is at least between 12 and 15 per cent.

AUXILIARY MACHINERY PLANT

THE introduction of gas plant to produce power for driving the auxiliary machinery on board ship is gradually gaining more attention and consideration from engineers, especially in view of the economy in working such when compared with steam plant worked from an auxiliary or a main boiler. There is no doubt that steam plant for the deck machinery is not economical: that it is even wasteful most engineers will agree; and, when all the circumstances are considered, this is not to be wondered at. The proved extravagance of the small donkey boiler, built to limits which were set down on the presumption that all the winches would not be working together, led to an improvement in this respect; but it was a hard battle between the shipbuilder and the shipowners' representative. The greater economy in working expenses gained with a boiler of adequate sizes, added to the reduced risk of damage and deterioration, was productive of good, not only financially, but morally, as it reduced the consequential worries and strife of tongues which arose due to the shortness of steam, while efforts were being made at critical times to obtain a pint out of a gill measure, with the wage-earning cargo hanging in the balance.

The demand for economy with an adequate steam supply called attention to possible improvements in all the steam-using auxiliary machinery, and winches, windlasses and pumps were closely watched and kept up to a standard. A further step was made when condensing plant was added to the equipment of the deck machinery, increasing economical results and decreasing the risks, scalding water being no longer thrown from the waste steam pipe to the danger of the lieges, and the steam-supplying boiler being fed by hot water regularly, with consequent steadier steam and less tendency to the bearing of false witness. The hydraulic system for working cargo is economical in steam and for a passenger steamer is preferable to the most silent of winches, but the initial cost and other disadvantages—amongst others, that which arises from low temperature conditions have contributed to exclude it from general use.

The adoption of gas plant in workshops has demonstrated to engineers its capabilities; at the same time its economy and adaptability have been proved by experience on land. The question remains, How can the power generated by the plant be most suitably applied to the deck machinery? and to this question the electric system forms the probable solution. There are two papers to be read on September 4th at the Shepherd's Bush Exhibition bearing on the subject, which may tend to further enlightenment, and we shall read them with an interest born of a desire for economy wedded to efficiency.

RUSSIAN ARMOURED CRUISER "RURIK."

TO many students of naval architecture the *Rurik* was perhaps the most interesting ship present at the recent gathering of our Home and Atlantic Fleets in the Solent on the occasion of the Czar's visit. Together with the *Makaroff*, and a couple of torpedo boats, she acted as escort to the *Standard*, and although dwarfed by our giant "Indomitables," which joined the Russians in the Channel, she made a magnificent picture when steaming up Spithead.

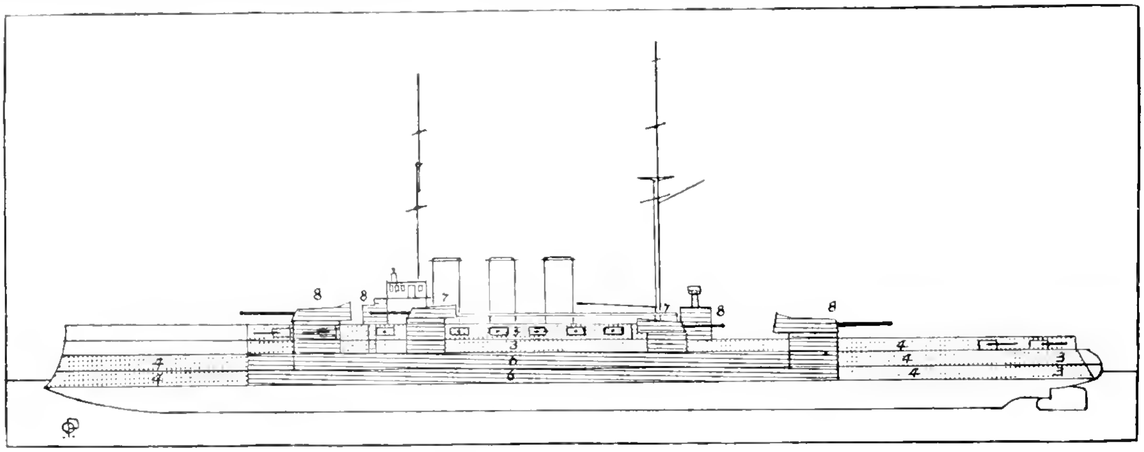
Laid down at Barrow in September, 1905, she was launched on November 17th, 1906, and completed in September, 1908, exactly three years after the keel-plate was laid. Although two more of her class are reported as projected, there is but little likelihood of their materializing now that the advent of the "battle-ship-cruiser" has made the type more or less obsolescent. although for her size the *Rurik* is a magnificent fighting ship. Upon a displacement of 15,000 tons she carries four 10-in. guns, paired off in 8-in. turrets on the centre line fore and aft, eight 8-in. guns in four twin turrets at the corners of the amidships section of the ship, and twenty 4·7 in. quick-firing guns in a main-deck battery. Fourteen smaller guns and two 18 in. submerged torpedo-tubes complete her offensive equipment. In the annexed table we make the usual comparison with contemporary foreign ships of, or about, her displacement, from which it may be seen that with the exception of the Japanese *Ibuki* she is superior to any pre-*Invincible* cruiser afloat.

The *Rurik* is a cruiser edition of the *Imperator Pavel* class of battleship, and like them, embodies certain methods of protection which are the outcome of the lessons of the late war. As may be seen from the plan herewith, her hull is practically entirely plated with 6 in.—3 in. armour, making her in this respect a modern edition of the French *Dupuy-de-Lôme*, the finest cruiser afloat in her day. It will at once be seen that this is an essentially different system of protection from that employed in our own ships, where the armour is expended solely on the belt and big guns, leaving the q.f. battery and a large portion of the hull open to shell fire. Which distribution is the better depends greatly upon the calibre of the enemy, and war rôle of the particular ship in question; should she be designed to "lie in the line" at a pinch, a thick belt and adequate gun protection is necessary to withstand the heavy projectiles from 12-in. and 11-in. guns. On the other hand, a ship built for cruiser work pure and simple, can afford to sacrifice some inches of armour from gun positions and belt, which can be better utilized in protecting the hull and q.f. batteries. Hence the *Rurik* rather belongs to the latter class. In her design, everything was calculated so that the maximum of protection should be procured. Thus, the belt is 270 feet long and 12 feet deep: the magazines are all armoured and a vast amount of internal sub-division of the hull renders her practically torpedo-proof, although at present no torpedo nets are carried.

As regards speed, the *Rurik* was not required to attain any fancy full-power figures, but an easy 21 knots continuous steaming was contracted for. She reached 22·4 knots, and made 21·5 with 20,675 I.H.P. for 10 hours. Her gun trials also were exceptionally

The Russian Cruiser "Rurik."

severe indeed it is said that the *Rurik* passed through the most severe and exhaustive series of trials under the supervision of the Russian officials that any warship has ever undergone. A great many minor alterations to fittings and mountings were made during construction at their request, hence it is not surprising



Russian Cruiser *Rurik*. Plan

that certain defects developed when she reached Russia which might not otherwise have come about. The extent of these is uncertain, but there is no doubt that the ship has been under repair and alteration for the last half-year or so—which, however, reflects no discredit upon the Barrow firm, who handed her over to the Russian Admiralty in perfect condition, but

COMPARATIVE TABLE.

No. in Class	Nationality.	Displacement in tons	Dimensions in feet.	Armament	T. Tubes	Protection. A	B	C	D	E	I.H.P.	Speed.	Boilers.	Coal.	Launched.
1. *Rurik*	Russia	15,000	490 × 75 × 26	4 10" 8 8" 20 4·7"	2	6" 4" 3"	8"	7"	1½"	6"	19,700	21	Belleville	1200 / 2000	1906
3. *Shannon*	G. B.	14,600	520 × 75½ × 27*	4 9·2" 10 7·5" 14 12 pdr.	5	6"—4" 3"	8"—6"	8"—6"	1"	6"—4"—3"	27,000	23	Yarrow or Babcock	1000 / 2000	1906
4. *Pisa*	Italy	10,000	461 × 69 × 24½	4 10" 8 7·5 16 14 pdr	3	8" 3½"—2½"	6½"	7"	?	7"	19,000	22·5	Belleville	660 / 1500	1907
1. *Blücher*	Germany	15,500	507 × 82 × 27*	12 8·2" 20 24 pdr	4	6"—4" 3"	6"		?	?	32,000	24	Schulz	1000 / 2000	1908
2. *Ibuki*	Japan	14,620	450 × 75½ × 26	4 12" 8 8" 14 4·7 4 14 pdr	—	7" 4" 4"	7"	6" 5" battery	2"	5"	25,000	21·5	Miyabara	600 / 2000	1907

Protection: A Belt amidships fore-aft.
B Big gun turrets.
C Secondary guns.
D Protective deck.
E Lower deck side.

* Max. draft.

only emphasizes the fact that alterations made in design during construction often lead to minor defects developing during service.

In appearance the *Rurik* greatly resembled the Italian *Pisa*, excepting that the pole forward she originally carried has now been lengthened into a fore-mast, and consequently modified the similarity. The long forecastle and short funnels tend to exaggerate her actual length which on the broadside looks immense. The 4·7" main deck battery is well spaced and protected, the fore and after guns being recessed to permit of axial fire. Fire control is directed from armoured stations at the ends of the superstructure, while the gunports in all the turrets are particularly designed to allow for high-angle firing. The main-mast carries a search-light top low down, and a platform at the "strike," which will probably be utilised for "spotting," as in our own ships.

Finally, the ship has been named in accordance with the decision to commemorate all those lost during the war, by reviving their names in new vessels. The last *Rurik*, it will be remembered, was sunk in the action between the Vladivostock squadron and Karimura's ships; the name perpetuates the memory of one of the heroes of ancient Russia.

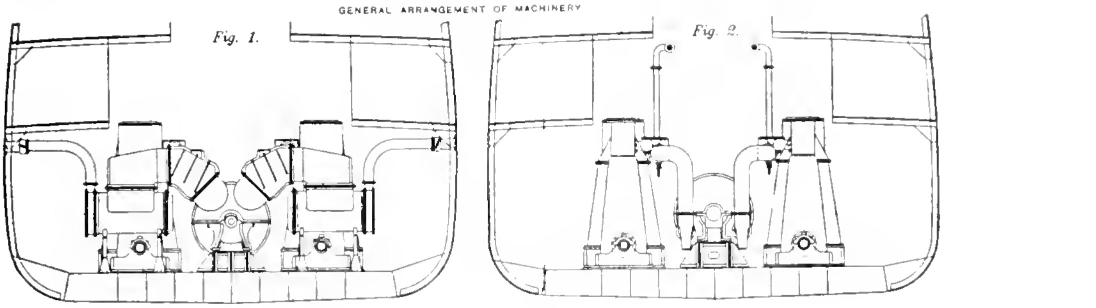
Motor Lifeboats.—Under the provision of Section 427 of the Merchant Shipping Act, 1894, the Board of Trade have made the following rule for life-saving appliances:—Notwithstanding anything contained in the rules relating to life-saving appliances dated Feb. 10th, 1902, it shall be permissible in the case of such foreign-going passenger steamers or emigrant ships as are required under Division A, Class 1, or Division A, Class 2, of those rules to carry more than four boats placed under davits, to substitute a motor lifeboat, approved by the Board of Trade, for one of the boats under davits. "Proper appliances shall be provided for putting any such motor lifeboat into the water. The lifeboat shall also be adequately provided with fuel and kept so as to be at all times fit and ready for use."

NOTES ON THE TRIALS AND PERFORMANCES OF THE S.S. "OTAKI," FITTED WITH A COMBINATION OF RECIPROCATING AND TURBINE MACHINERY.

By Engineer-Commander W. McK. WISNOM, R.N. (Retired).

IN 1894 the Hon. C. A. Parsons took out a patent for the "combination" of a reciprocating engine with a steam turbine, the object of which was—"To increase the power obtainable by the expansion of the steam beyond the limits possible with reciprocating engines."

GENERAL ARRANGEMENT OF MACHINERY



A paper on the subject by the Hon. C. A. Parsons and Mr. R. J. Walker was read at the Spring Meeting of the Institution of Naval Architects, in 1908, and the present remarks may be regarded as supplementing the reference then made to the *Otaki*.

The *Otaki* is the first merchant vessel fitted with this "combination" system of machinery. The vessel was built for the New Zealand Shipping Company by Messrs. Denny, of Dumbarton, and was delivered in November, 1908. She has since completed a voyage to New Zealand and back. She is virtually a sister ship to the twin-screw vessels *Orari* and *Opawa*, fitted with reciprocating engines, which were built by Messrs. Denny for the same Company, and delivered in 1906. The only important differences in the vessels are :—

(1) The length of the *Otaki* was increased 4 ft. 6 in. to make up for the loss in cargo capacity due to three shaft tunnels instead of two.

(2) The design of stern and stern post was modified in the *Otaki* as necessary for three propellers instead of two.

The boiler installations in the three vessels are identical, and consist of five single-ended cylindrical boilers, fitted with Howden's forced draught system. Each boiler has three furnaces. The total grate area is 305 square ft., and the total heating surface 13,500 square ft. The working pressure is 200 lbs. per square inch.

The vessels being so nearly alike and the boilers similar, fairly accurate comparisons of the performances of the two types of machinery can be made.

The principal dimensions of the *Otaki* are :—

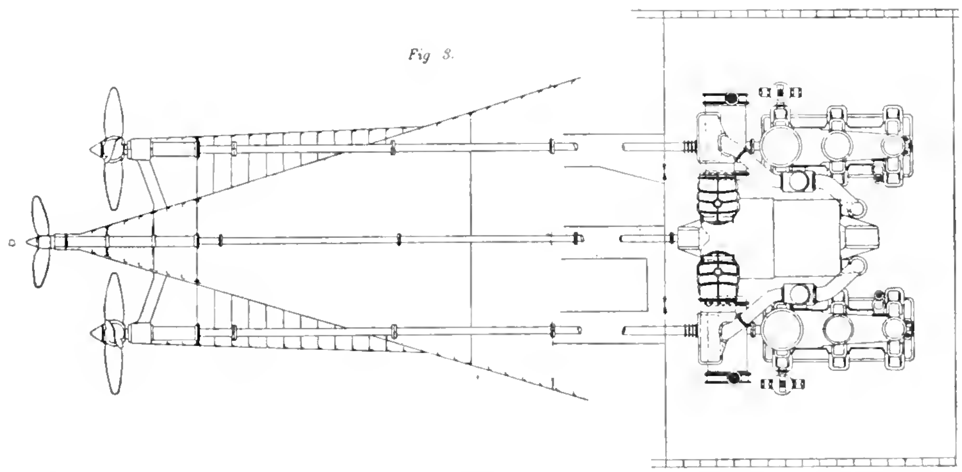
Length between perpendiculars..	464 ft. 6 in.
Breadth, moulded	60 ft.
Depth, moulded	34 ft.

The deadweight capability is about 9,600 tons on a draught of 27 ft. 6 in.

The engines of the *Otaki* consist of two sets of ordinary triple-expansion reciprocating engines, driving wing propellers, and a low-pressure turbine driving a centre propeller. The arrangement is shown in Figs. 1, 2 and 3.

In ordinary ahead working the reciprocating engines exhaust into the turbine, which can only revolve in one direction, but change valves are fitted, so that the reciprocating engines can also exhaust direct to the condenser. These change valves are operated by gear from the reversing shafts ; the act of reversing the reciprocating engines closes the connections between them and the turbine, and opens direct communication from the reciprocating engines to the condensers. The turbine is thus automatically thrown out of action when going astern. The operating gear for the change valves is also arranged so that the turbine can be cut out at any time without stopping, and the ship can then be manœuvred as an ordinary twin screw vessel. The arrangement also permits the turbine to be used in combination with one reciprocating engine only for ahead working. The arrangement of change valves and gear is shown in Figs. 4 and 5.

Two condensers are fitted, and each set of reciprocating engines exhausts direct to its own condenser when the turbine is not in use. The turbine exhausts to both condensers. A shut-off valve is fitted in the exhaust from the turbine to each condenser, so that in the event of a defect in either condenser, or its pumps or other connection, the corresponding



* Read in Glasgow at the Joint Summer Meeting of The Institution of Engineers and Shipbuilders in Scotland and The North-East Coast Institution of Engineers and Shipbuilders.

shut-off valve can be closed, and both exhausts led to the other condenser only, thus enabling repairs to be made without stopping any engine. The shut-off valves are shown in Figs. 6 and 7.

The diameters of cylinders of the reciprocating engines in the *Otaki* are 24½ in., 39 in. and 58 in. respectively, with a stroke of 30 in. The cylinders of the *Orari* and *Opawa* are 24½ in., 41¼ in. and 69 in. in diameter respectively, and the stroke 4 ft. The ratio of high-pressure to low-pressure cylinders is thus 1 : 5·6 in the *Otaki* and 1 : 7·93 in the sister ships fitted with reciprocating engines.

The turbine fitted in the *Otaki* is, generally speaking, of the ordinary Parsons low-pressure type. The diameter of rotor drum is 7 ft. 6 in., and the length of blades 4¾ in. in the first expansion to 12 13/16 in. in the last expansion.

A novel feature is that the drum is completely closed at both ends, and any leakage past the dummy is led away by an external pipe to the condenser. The object of this is to reduce the loss due to the cooling effect of the condenser on the internal surface of the drum, and to prevent corrosion.

The turbine spindles are packed with soft packing, separated into two parts by a metallic lantern ring. This ring enables

The feed pumps are of Woodeson's patent type.

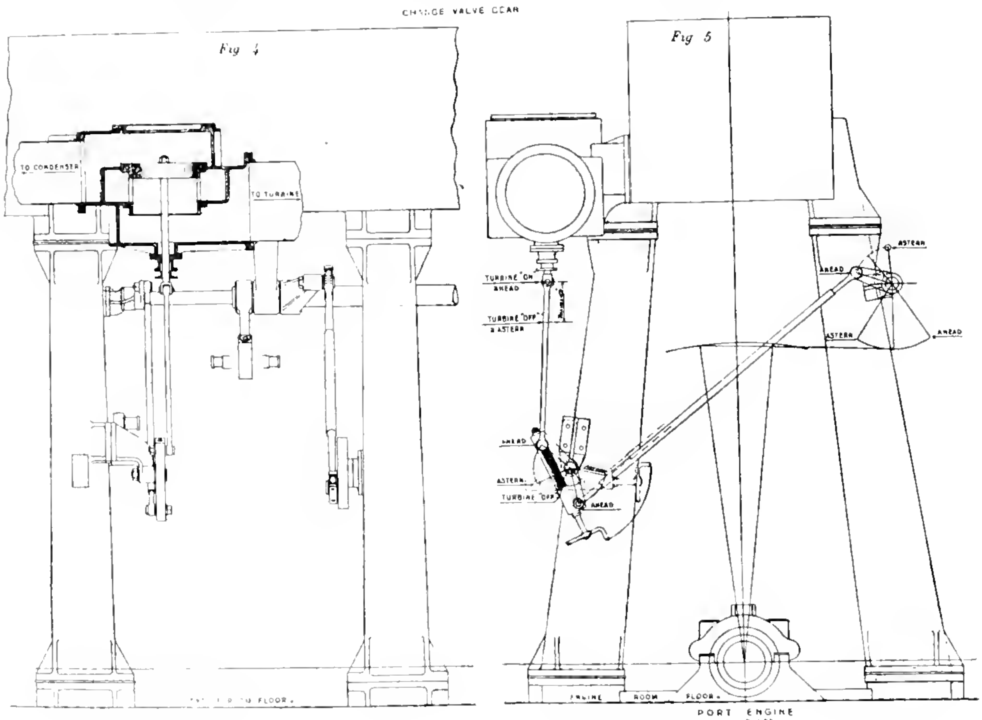
A surface feed heater is fitted in connection with the exhaust from auxiliary engines. Fig. 13 shows the general arrangement of the feed heater.

The vessel was designed for a continuous sea speed of 12 knots when fully loaded, but the contract provided for obtaining a trial speed of 14 knots with 5,000 tons of deadweight on board. The great difference between seagoing and trial conditions must be remembered when comparing sea performances and trial results.

Tables I. and II. give some particulars of the results of the trials.

The *Orari* obtained a mean speed of 14·6 knots on the measured mile at Skelmorlie. The *Otaki*, under the same conditions, with apparently greater ease, obtained a mean speed of over 15 knots for a total water consumption per hour of 6 per cent. less than the *Orari*. The total water consumption per hour in the *Otaki*, at 14·6 knots, was 17 per cent. less than in the *Orari* at the same speed. The total water consumption referred to here, and in subsequent comparisons, is that for the main and auxiliary engines.

In the *Otaki* the total water used in all the engines was



PORT ENGINE LOOKING AFT

the shaft to be surrounded by water between the two divisions of the packing, thus forming a water seal. The water is supplied under a slight head, and a gauge glass at each stuffing box indicates the head of water and whether air leakage is occurring. A full-sized model of the arrangement was kept running for a month on shore before it was decided to adopt this method of packing which has been found to work very satisfactorily on service. The stuffing box is shown in Figs. 8 and 9.

The lubrication of the turbine bearings is on the adjustable sight-feed system, and the oil pump is worked off the turbine shaft. An alternative oil pump is worked from the air pump lever of one of the reciprocating engines.

The condensers were made to the design of the Contraflo Condenser Company, and the total cooling surface of the two condensers is 6,000 square ft. Figs. 10, 11 and 12 show the design of the condensers.

There is one single-acting air pump of the ordinary bucket type worked from each set of main engines, the diameter of the bucket being 26 in. and the stroke 19½ in.

The circulating pumps have 16-in. suctions and discharges, and the diameter of the impellers is 48 in.

measured by tanks during the trials, and the number of strokes of the feed pumps was also observed.

The water consumption as calculated from strokes of the pumps is in all cases greater than that obtained by tank measurements, the difference being about 3 per cent. at the higher speeds.

The water consumption was not measured by tanks in the *Orari*, being estimated only from the number of strokes of the feed pumps. In order to make a fair comparison of the consumption in the two ships, it is necessary to consider the water as estimated from strokes of the feed pumps in both cases, or to correct the estimated consumption in the *Orari* to make it comparable with the tank measurements of the *Otaki*. In view of the greater accuracy of tank measurements, the latter method of comparison has been adopted.

The corrected total water consumption of the *Orari*, at a speed of 14·6 knots, was 88,300 lbs. per hour, or 16·5 lbs. per i.h.p. per hour. The latter figure is about the mean of the results obtained under similar conditions in a number of vessels with machinery of similar design, and so may be regarded from a practical point of view as sufficiently reliable for purposes of comparison.

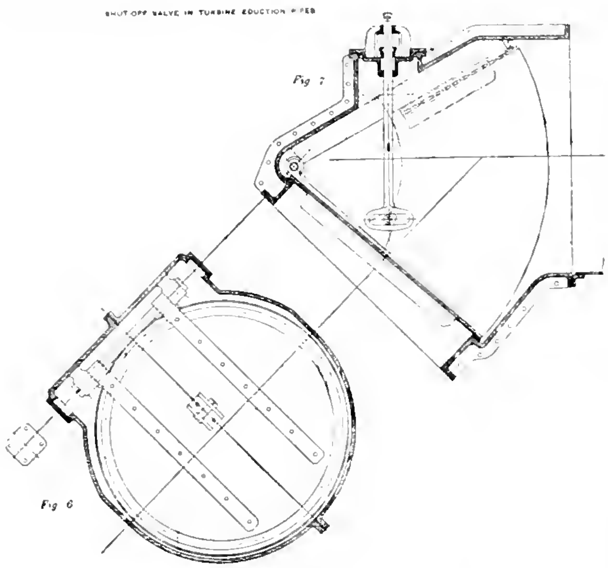


TABLE I.

Particulars of progressive runs on the measured mile at Skelmorlie, 31st October, 1908.

	Mean of 2 Runs.	Mean of 2 Runs.	Mean of 2 Runs.	Mean of 2 Runs.
Total horse power (i.h.p. of reciprocating engines plus s.h.p. of centre shaft)	6,857	5,348	4,704	3,282
Speed in knots	15·02	14·278	13·829	12·518
Revolutions—Port	103	96·2	93·1	84·6
,, Starboard	103·5	97·9	93·5	83·4
,, Centre	224·5	209·7	197·2	172·1
Total water consumption per hour by tanks (taken from curve) ....lbs.	82,000	67,300	60,200	44,600
Total water consumption per hour from strokes of feed pumps (taken from curve) lbs.	84,700	69,300	62,300	48,200
Water per h.p. per hour by tanks lbs.	11·95	12·6	12·8	13·6
Water per h.p. per hour by pumps ....lbs.	12·35	12·95	13·25	14·7
Mean absolute pressure in h.p. receivers by indicator diagrams :— ....lbs.	193	178	166	135
Absolute pressure at turbine inlet (measured by column of mercury) ....lbs.	9·5	7·62	6·70	5·0
Vacuum at exhaust end of turbine (measured by column of mercury) ....ins.	28·1	28·2	28·4	28·5
Vacuum in condenser by gauge, ins.	28·2	28·4	28·3	28·5
Barometer ....ins.	30·06	30·06	30·06	30·06
Temperature of sea water Deg. Fah. .	56	56	56	56
Temperature of circulating discharge ....Deg. Fah. .	70	67	70	70
Temperature of feed water at hot well ......Deg. Fah. .	72	70	73	74
Draught of ship forward	—	18′ 10″	—	—
,, aft	—	21′ 4″	—	—
,, mean	—	21′ 1″	—	—
Displacement ....tons	—	11,716	—	—
Water consumption per i.h.p per hour based on i.h.p. of *Orari* :—				
By tanks ....lbs	13·66	13·7	13·8	14·07
By pumps ....lbs.	14·12	14·1	14·3	15·2

TABLE II.

Particulars of Various Trials.

	1	2	3	4	5	6
Total h.p.	6,857	7,054	6,030	5,420	4,100	3,400
Speed in knots .	15·02	15·09	14·71	14·25	13·35	11·7
Revolutions—						
Port	103	104·0	99·7	96·7	90·1	82·9
Starboard ..	103·5	104·5	101·1	97·5	89·6	83·5
Centre	224·5	228	214	203·1	179·0	160·4
Total water consumption per hour by tanks (taken from curve) .. lbs.	82,000	83,000	75,200	66,700	—	—
Do. from strokes of pumps (taken from curve) ..lbs.	84,700	86,700	77,600	68,700	56,400	40,800*
Water per h.p. per hour :						
By tanks lbs.	11·95	11·9	12·47	12·3	—	—
By pumps lbs.	12·35	12·3	12·87	12·07	12·75	14·4*
Coal consumption per hour lbs.	—	—	—	—	—	4800
Coal consumption per h.p. per hour lbs.	—	—	—	—	—	1·387
Mean absolute pressure in h.p. receivers by indicator diagrams ....lbs.	193	196	180	195	—	175
Absolute pressure at turbine inlet measured by mercury column lbs.	9·5	9·8	8·5	7·5	5·75 (by	5·2 gauge)
Vacuum at exhaust end of turbine measured by column of mercury ....ins.	28·1	28·0	28·1	28·2	—	—
Vacuum in condenser by gauge ins.	28.2	28.2	28.35	28.4	28.75	28.1
Barometer ins.	30.06	30.0	30.0	30.1	30.2	—
Temperature of sea water Deg. Fah.	50	56	50	50	50	55
Temperature of circulating discharge Deg. Fah.	70	74	70	70	70	65
Temperature of feed water at hot well, Deg. Fah	72	74	73	73	73	70
Draught of ship,						
Forward	18′ 10″	18′ 10″	—	—	—	22′ 6″
Aft	21′ 4″	21′ 3″	—	—	—	23′ 10″
Mean	20′ 1″	20′ 0½″	—	—	—	23′ 2″
Displacement tons	11,716	11,600	—	—	—	8,710
Water per i.h.p. per hour based on i.h.p. *Orari*.						
By tanks lbs.	13.66	13.8	13.65	13.7		
By pumps lbs.	14.12	14.25	14.1	14.1	14.54	

* These are actual results.

Column (1) full speed on mile (mean of two runs) Oct 31, [illegible].

Column (2) ,, ,, Nov [illegible].

Column (3) mean of two runs on mile. Nov [illegible] 1908

Column (4) continuous run of one hour. Nov 2, 1908

Column (5) continuous run of two hours. Nov 5, 1908

Column (6) run from Clyde to Liverpool (4 hours) Nov 21, 22, 1908.

The records of water consumption are in most cases based on observations on the measured mile runs, and it is admitted that such records are liable to error on account of the short duration of the observations. It has therefore been considered preferable to plot the results of various observations, to draw a curve of mean results, as shown in Fig. 14, and to use figures taken from the curve in making the comparison previously given and those which will be referred to later.

TURBINE GLANDS

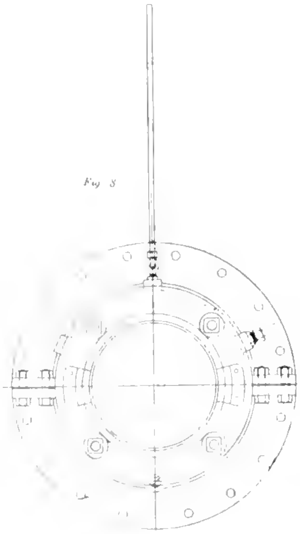


Fig 8

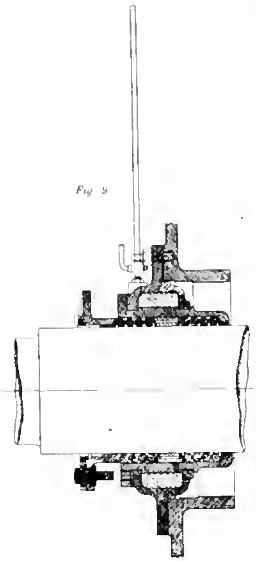


Fig 9

The actual curves from which the figures were taken were, of course, on a larger scale than those herewith, and care was taken in drawing the curves not to give unduly favourable results.

The following auxiliary engines were at work during the trials :—

- 2 Main circulating engines.
- 1 Air pump for auxiliary condenser.
- 1 Circulating pump for auxiliary condenser.
- 1 Main feed pump.
- 1 Fan engine.
- 1 Electric light engine.
- 1 Steering engine.
- 1 General service pump.

The evaporators were not in use during the trials on the Clyde, and the results do not include any allowance for steam used by evaporators, or make-up feed in any case. On the other hand, it was found that all the auxiliary exhaust steam could not be utilized for heating the feed water, so there was a certain amount of loss through taking part of the auxiliary exhaust direct to the auxiliary condenser.

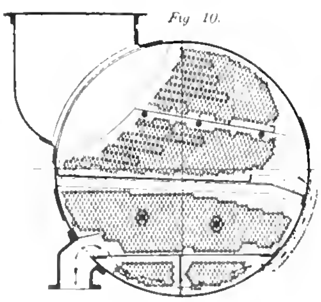


Fig 10.
CROSS SECTION

The coal consumption was not ascertained on these trials, the time being too short to admit of accurate measurement.

On the run from the Clyde to Liverpool, with the vessel partly loaded, on 21st and 22nd November, 1908, at about half the full power, records were taken for fourteen hours and the coal was measured.

The water was estimated from the total number of strokes of the feed pump during the period.

The evaporators were not in use.

The coal consumption works out at 1·387 lbs. per h.p. per hour for all purposes, but, as will be seen from the particulars of water consumption, a lower coal consumption per h.p. might be anticipated at higher power.

The coal used was Scotch, of the following quality, as analysed by two independent analysts :—

	(1) Per cent.		(2) Per cent.
Carbon	67·15	..	66·48
Gas, tar, etc.	24·02	..	24·28
Sulphur	·84	..	
Ash	6·13	..	7·50
Water	1·86	..	1·74
	100		100
Calories in heat units (cent.)	7470	..	7564
Heating power in lbs. of water evaporated from and at 212 deg. Fah. per lb. of coal	13·91	..	14·07

Accurate comparisons of coal and water consumptions per horse power in two vessels driven by reciprocating engines and steam turbines respectively are rendered difficult by the distinction between shaft horse power and indicated horse power. The actual shaft horse power of the reciprocating engines is seldom known, and an assumed ratio of shaft horse power to indicated horse power, based on general information, may lead to error. Further, as the efficiencies of the propellers may differ sensibly, and we are concerned with the efficiencies of the whole propelling apparatus, the comparison of the two systems cannot be based on shaft horse power alone.

If it be desired to compare the coal or water consumption of two vessels in relation to power, then it appears preferable to use the known indicated horse power of the reciprocating engined ship as a basis, provided the propellers are of normal design. We are thus eliminating any difference in efficiency of propellers, and dealing with power in the terms which custom has rendered familiar. In the case of two sister vessels the same horse power would be used for both ships, and this method of comparison would therefore give the same results as comparison by total consumption.

CONDENSER

Fig 11

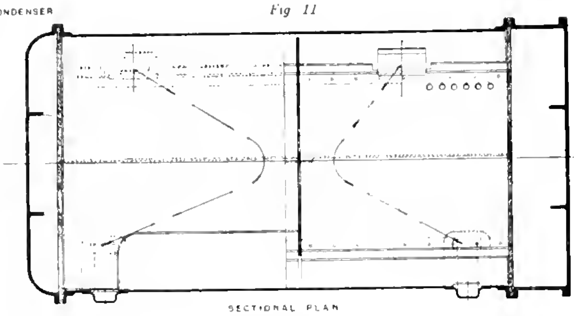
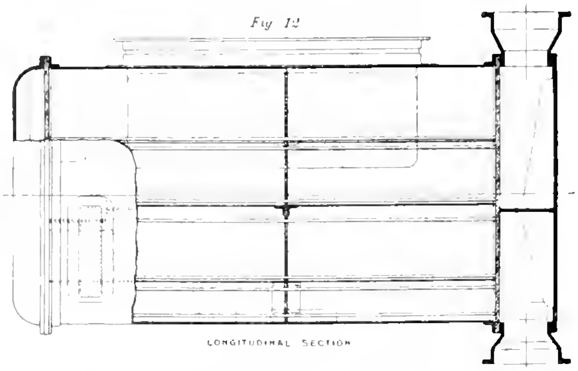

SECTIONAL PLAN

Fig 12


LONGITUDINAL SECTION

From a design point of view, the most reliable comparison appears to be one based on water consumption per E.H.P. where this is available, while from a practical point of view it is obvious that in sister vessels with similar boiler installations the coal consumption per mile or per hour at the same speed affords the best comparison of the two systems.

Figure 15 shows the i.h.p. and speed curves of the *Otaki*, *Orari* and *Opawa*.

The proportion of total power developed in the turbine of the *Otaki* was found to vary with the speed. At full power this proportion was about one-third; while at very low speeds the turbine was doing only a small proportion of the work.

At a speed of 14·6 knots, the indicated horse power in the *Orari* was 5350, and the corresponding power in the *Otaki* was 5880. At this speed the e.h.p. was 3210 in the *Orari* and 3350 in the *Otaki*, the propulsive coefficients being thus 60 per cent. and 57 per cent. in the respective ships. The propulsive coefficients in the *Otaki* at full speed fell to 54 per cent.

Applying now to the trial results of the *Otaki* and *Orari*, at a speed of 14·6 knots, the various methods of comparison referred to:—

(1) The comparison based on total water consumption and speed has already been dealt with.

(2) A water consumption of 21·9 lbs. per e.h.p. per hour in the *Otaki* corresponded to 27·5 lbs. per e.h.p. per hour in the *Orari*, the gain on this basis being, therefore, 20 per cent.

(3) The lowest line of Tables I and II. shows the water consumption per i.h.p. in the *Otaki*, taking the i.h.p. as that obtained in the *Orari* for corresponding speeds. On this basis a water consumption of 13.7 lbs. per i.h.p. per hour in the *Otaki* corresponded to 16·5 lbs. per i.h.p. per hour in the *Orari*, *i.e.*, the gain in the *Otaki* was 17 per cent.

A summary of the results of these comparisons is given in Table III.

TABLE III.

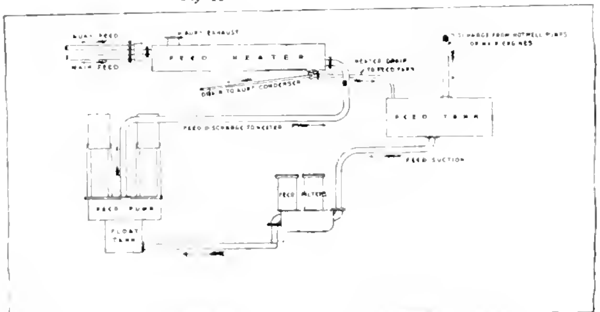
Summary of Comparisons of Trial Results of the *Otaki* and *Orari* for a speed of 14·6 knots on the measured mile.

	E.H.P.	I.H.P.	Propulsive Coefficient	WATER CONSUMPTION. Total per hour *	Per E.H.P. per Hour.	Per I.H.P. of Orari per Hour*
				lbs.	lbs.	lbs.
Otaki	3350	5880	57 per cent.	73,300	21·9	13·7
Orari	3210	5300	60 ,,	88,300	27·5	16·5
Gain per cent. in *Otaki*				17	20	17

NOTE.—Columns marked * do not take into account the difference of e.h.p. in the two ships; these two methods of comparison should show the same gain.

In connection with the comparisons of water consumption the results obtained in two representative vessels built for cross-Channel passenger service may be of interest. One

Fig 13 ARRANGEMENT OF FEED HEATER



vessel was fitted with twin screws and reciprocating engines, and the other with turbines and triple screws. The reciprocating engines were of the ordinary fast running triple-expansion type fitted in such vessels and with a smaller ratio of expansion than usual in slower vessels. These engines were not so economical as those fitted in the *Orari*, but are believed to be economical engines of their type. The boilers of the turbine-engined ship were smaller than those of the reciprocating-engined ship, and the former obtained a slightly greater speed. The propulsive co-efficient in the reciprocating-engined ship was 55.5 per cent. and in the turbine-engined ship 53 per cent. At the maximum speeds the reciprocating engines consumed 30·6 lbs. of water per e.h.p. per hour, and the turbines 26·4 lbs. per e.h.p. per hour. This represents a gain of 14 per cent. in consumption by the use of turbines, and it may also be incidentally remarked that the reduction in weight of machinery per e.h.p. was 18 per cent.

Fig 14 TOTAL WATER CONSUMPTION AND SPEED. S.S. "OTAKI"

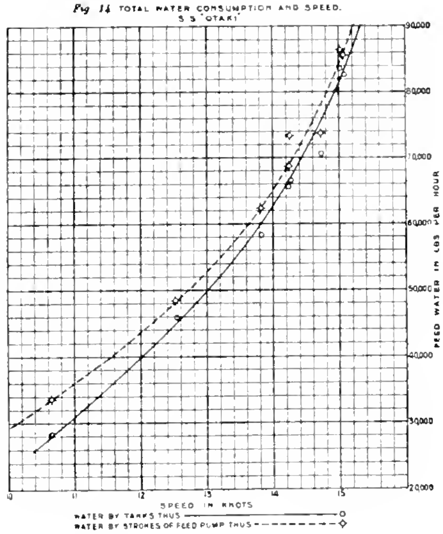


TABLE IV.

Initial Pressures and range of Temperature in Cylinders of the *Otaki* at full speed.

	RECIPROCATING ENGINES. H.P. Initial Pressure Diagram	M.P. Initial Pressure Diagram	L.P. Initial Pressure Diagram	L.P. Exhaust Pressure Diagram	TURBINE. Initial Pressure Mercury Column	Exhaust Pressure Mercury Column
Absolute pressures ......lbs.	196	91·5	36	11·5	9·8	1·0
Corresponding temperatures assuming saturated steam. Degrees Fah. (approximately)	380	321	261	200	192	102
Temperature Range degrees	59	60	61	8 (drop)	90	
Theoretical available heat units per lb. of steam B. Th.U. (approximately) ..		200			120	

Table IV. shows the initial pressures, range of temperature, etc., in the different cylinders as taken from two sets of indicator diagrams at full speed in the *Otaki*. It will be observed that the range of temperature in the low-pressure cylinders of the reciprocating engines is about the same as in the other cylinders; also that the theoretical heat available in the turbine is over one third of the total available heat.

Turning now to the performance of the *Otaki* on service the coal consumption on the voyage from Liverpool to Teneriffe was 11 per cent. less than the mean for the sister vessels *Orari* and *Opawa* under similar conditions and at practically the same speed.

On the whole round voyage from Liverpool to New Zealand and back, the average speed maintained by the *Otaki* was 11·09 knots. This speed does not represent the sea speed which the vessel is capable of maintaining, the power required being only about half that developed on trial, nor is it the most suitable for obtaining the lowest consumption of coal per h.p..

but it was the speed arranged to suit the owners' conditions of service. The initial pressure in the turbine was only about 1·5 lbs. absolute.

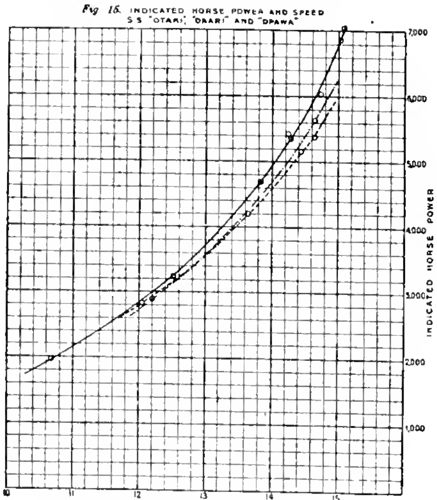
A careful comparison of the coal consumption for the round voyage with that of the sister ships on similar voyages at the same speed shows an apparent gain of about 8 per cent. This gain represents about 500 tons of coal for the round voyage, and as the ship leaves England with sufficient coal for the outward run would permit of the cargo carried being increased one-half that amount. Compared, however, with the results on trial and on the voyage as far as Teneriffe, this result appears disappointing. It is, however, not really so, as there were various adverse circumstances to account for the apparent falling off in economy which it is not proposed to enter into here, as they were not attributable to the type of machinery. One contributing cause, however, was that, on docking, the vessel was found to have an abnormally foul bottom.

It is confidently anticipated that a greater gain in economy will be obtained in future.

The engines made a non-stop run outwards from Teneriffe to New Zealand, a distance of 11,669 miles as logged, which is probably the longest continuous run yet made by a marine turbine. The turbine worked perfectly satisfactorily throughout the whole round voyage.

The condensers were designed with a view to maintaining a high vacuum in tropical waters, and the following are typical

Fig 16. INDICATED HORSE POWER AND SPEED S.S. "OTAKI," "ORARI" AND "OPAWA"



SPEED IN KNOTS
"OTAKI" ———— "ORARI" - - - - - - "OPAWA" — — — —
NOTE — THE I.H.P. OF "OTAKI" HAS BEEN TAKEN AS THE SUM OF I.H.P. FOR WING SHAFTS AND S.H.P. FOR CENTRE SHAFT

records of the results obtained with sea water of various temperatures:—

Height of Barometer ...... ins.	30·02	30·05	30·00	30·00	30·09	29·85	29·65
Vacuum ins.	28¼	28½	28¾	29	29	29	29
Temperature of water in hot well (Degrees Fah.) ..	103	98	94	86	83	74	71
Temperature of sea water (Deg. Fah.)	84	80	76	68	63	56	53
Temperature of circulating discharge (Degrees Fah.)	98	94	91	82	80	68	66
Vacuum corrected to 30.-in. barometer, and reduced ·35 inches to allow for error in gauges	27·88	28·1	28·3	28·65	28·56	28·8	29

The revolutions of the main reciprocating engines, when these records were taken, were about 81 per minute, and the revolutions of the circulating pump 150 per minute.

The vacuum is given as recorded, but a slight reduction should be made in each case for errors in gauges. The *maximum* error observed in the gauges on trial as compared with the mercurial column was ·35 inches, while the mean error was under ·2 inches. The gauges were not tested after arrival in England, so that the *absolute* accuracy of the records cannot be vouched for.

From these records, even with a deduction corresponding to the *maximum* error observed, it appears that practically the possible vacuum with the respective hot well temperatures was obtained. The drains from the turbine are always open to the air pump suction, so that the temperature of the water in the hot well was probably slightly higher than that of the water at the bottom of the condenser. Further, there may be slight errors due to the vacuum being recorded to the nearest quarter of an inch.

The vacuum gauges are placed at about the level of the middle of the condenser.

It will be admitted, however, that even allowing a reasonable margin for errors in observation and increased error in gauges the results appear very satisfactory, but it has to be remembered that the vessel was only steaming at about half power.

Figures for vacuum obtained on the trials are given in Tables I. and II. On these trials there was air leakage at l.p. glands, which was subsequently reduced.

As regards the feed heater, with a pressure of from 8 to 12 lbs. in the auxiliary exhaust, the temperature of the feed water was raised from hotwell temperature to 210 to 215 degrees Fah., while using only part of the auxiliary exhaust steam. Some gain in economy would be obtained by leading the surplus auxiliary exhaust steam to the turbine

One of the most difficult problems in connection with the design of machinery for turbine-driven vessels is the design of propellers. It is well known that, considered from the point of view of efficiency of engines only, a high number of revolutions is most suitable for the turbine, while from the point of view of efficiency of propellers only—with the present knowledge of propeller design—a lower number of revolutions seems to be required, and turbine installations for marine propulsion are, therefore, a compromise between these two opposing factors.

In the combination system these difficulties are accentuated, as the best distribution of power has to be considered in conjunction with the effect of the difference in revolutions of centre and wing shafts. It is conceivably possible that the whole gain in power obtained by the turbine may be lost by defective design or arrangement of propellers.

In this connection two recent tank experiments with models of different types of ships may be mentioned. In one case the best results were obtained by putting a *reduced* proportion of the total power through the centre screw, while in the other case the best results were obtained by putting an *increased* proportion through the centre screw.

In the case of the *Otaki* a large number of tank experiments and experiments with an electrically-driven 50-ft. model were made on the Gareloch before the dimensions of the propeller were decided upon.

The dimensions of the engine-room in the *Otaki* were the same as in her sister ships, and were found sufficient to admit of an arrangement of machinery which gave satisfactory access to all working parts.

The total weight of machinery in the *Otaki* was about 30 tons more than in her sister ships—an increase of about 3·25 per cent. In view, however, of the greater economy of the combination system the boilers of the *Otaki* might have been reduced. Allowing for this, the total weight of an installation of the combination system would not exceed that for reciprocating engines. The saving in bunker capacity would more than balance the loss in cargo carrying capacity due to the three tunnels, and hence in future vessels of similar design no increase in length would be necessary. In the *Otaki*, however, the owners desired no alteration in the bunker capacity or the boilers—hence the increased length.

The possible difficulty in manœuvring has been advanced as an objection to the combination system. No difficulty of any kind in connection with manœuvring was experienced in the

Otaki. The maximum power cannot be developed when going astern, but it was found that astern power sufficient for all practical purposes had been provided.

Another objection which has been raised is the possible effect of oil from the reciprocating engines on the turbine blades, and possible clogging of the first row of fixed blades by oil and other foreign matter. Pending experience on this point it was decided not to fit oil separators or strainers in the *Otaki*, a large pocket only, with a baffle and examination and cleaning doors, being provided at the lower end of the steam inlet pipes to the turbine. After the trials it was found that there was no collection of oil or other foreign matter. A further examination was made at Teneriffe and another on arrival in New Zealand with similar results. On arrival in England the turbine cover and rotor were lifted and a thorough examination made. There was a slight deposit in the inlet pipe pockets, but the blades were in good condition and quite clean, with the exception of a few in the first rows at the lowest part of the turbine on which there was a very thin layer of oily deposit. From the experience on this voyage there appears no reason to anticipate any trouble from this cause.

It is admitted that there are discrepancies in the records of the trial results of the *Otaki*, and that the trials were of too short a duration for absolutely accurate measurements of water, but allowing for discrepancies and possible errors in observation, the results, on the whole, taken in conjunction with the performance of the vessel on service, are considered sufficient to show that a high degree of economy may be anticipated in the combination type of engine—an economy probably higher than has been obtained in any other type of marine engine for vessels of this class. There appears little doubt that in vessels of low speeds, for which Parsons turbines alone are unsuitable, and where economy is of primary importance, this system can be advantageously employed.

The crux of the question appears to be the design of the after body of the ship and the propellers, and the position of the propellers. With further information and experience improvements in the design of these particulars may be anticipated.

The Hon. C. A. Parsons has shown how to obtain additional power for the same steam consumption; the problem now is how to utilize this power most efficiently; in short, to make three propellers as efficient as two, and to get the full benefit of this additional power.

It is hoped, while the information given in these notes is not so complete, accurate, or consistent as might be desired, that in view of the importance of the subject it is sufficient, as it stands, to be of interest.

The New Zealand Shipping Company is to be congratulated on its courage in allowing the experiment to be made, and it is desired, in conclusion, to thank the officials of the Company for their courtesy in supplying much of the information contained in this paper and allowing it to be published.

APPENDIX.

Since the foregoing was written the *Otaki* has completed another voyage to New Zealand at a mean speed of 12·35 knots, and the anticipations as regards improved economy have been realized.

As the speed was greater than that of sister vessels under similar conditions, it is difficult to make an exact comparison, but it appears that the gain in coal consumption in the *Otaki* as compared with similar vessels was not less than 12 to 15 per cent.

Fire on the "Lucania."—LINER GUTTED AND SUBMERGED.—On Saturday, the 14th August, a disastrous fire occurred on board the favourite Cunarder *Lucania*, resulting in a great amount of damage, partially caused by the ravages of the fire and partially by the destructive effects of the water after she had sunk. She was lying in the Huskisson Dock, Liverpool, having been laid up for about a month previously, and was to have sailed again on October 2nd, but she will now, of course, have to be laid up for a considerable time. It is a mystery as to how the fire occurred or where it originated, but from the accounts of several eye-witnesses it is supposed to have started in the saloon galley, although other evidence states that flames were seen to burst from several parts of the vessel at once. Two of the Cunard officers noticed a slight fire in the steerage galley, and this was promptly extinguished, but almost immediately after a larger fire broke out in the saloon galley, which was of a much fiercer character. The Cunard fire brigade were at work at once, but they were unable to stop the progress of the flames. The Liverpool Fire Brigade and the Liverpool Salvage Association were quickly on the spot, and with the combined efforts of the three brigades, together with the two Mersey Docks and Harbour Board's fire steamers, "Neptune" and "Hodgson," the flames were considerably reduced. The Liverpool Fire Brigade alone had over twenty branches at work, and the large amount of water which was being poured into her (estimated at about 2000 gallons per minute) completely gutted her, and caused her to sink, the ship resting quietly down on the bottom of the dock, with the water level considerably above her main decks. During the course of fighting the flames, the immense quantity of water caused her to take a sudden list towards the quay, and in doing so, she caught against the roof cranes on the top of the quay warehouse, damaging her funnels considerably. The fire lasted all Saturday night, and was not got under control until late on Sunday morning. She presented a most imposing spectacle as she blazed furiously away, and the sight attracted large crowds to the scene, to watch the operations. The ravages of the fire are very much in evidence on board the vessel, especially in the passenger accommodation, and what were perhaps the finest specimens of ocean-going luxury are now nothing but charred masses of timber and furniture. The grand staircase presents a scene of utter destruction, and the dining-room, smoke-room, state-rooms and library are also entirely destroyed. In the library, however, it is singular to note that although the whole room was practically destroyed, a large number of the books were in good condition, and had been hardly damaged by either fire or water. The fire has also badly damaged the bridge and bridge deck, also the captain's and officers' quarters. The captain's rooms did not fare quite so badly as the officers' quarters, which were completely gutted, and nothing was left except a few portions of oil skins, clothing, boots, etc., and it is also unfortunate that several important documents have been destroyed. Along the starboard promenade deck large portions of the planking are burnt and charred, and many of the plates badly buckled and twisted, presenting the appearance of a number of small tunnels. Portions of the deck-houses were bulged out and the starboard lighthouse was practically destroyed. Even the funnels and fiddley casings were much buckled and damaged by the intense heat, and many of the port-lights had to be broken to enable the firemen to attack the fire in the steerage portion. Several lifeboats were also partially destroyed. After the vessel sank and the fire was put out, divers were engaged plugging up the broken port-holes, and making everything tight for lifting her. The water in the dock was lowered until it uncovered her main decks, when pumps were placed on board and pumping operations commenced in order to raise her off her keel. This was very successful, and by Sunday night she was practically afloat again, but very low down in the water. Pumping was continued with all speed, and she was towed into dry dock for survey and repairs. The underwriters are being badly hit of late, and this disaster it is estimated will add over £100,000 to the heavy losses they have recently sustained.

OUR ANNOUNCEMENT.—The 32nd annual volume of "The Marine Engineer and Naval Architect" commenced with the August issue, and affords a favourable opportunity for intending subscribers to send in their names. They are respectfully referred to the form printed on page xxii, which should be filled up and sent to the office at 3, Amen Corner, London, E.C. The annual prepaid subscription is 7/6, including postage, sent direct from head office to any address.

The 31st volume, with complete index, tastefully bound, is now on sale. 488 pages of excellent reading matter, price 7/6, or by post securely packed, United Kingdom and Canada, 8/-; other countries, 8/6. Binding cases may now be obtained from the publisher, price 1/6, carriage 3d. extra. We shall be pleased to undertake the binding of readers' parts in publishers' cases at 2/6 per volume. Prices for other bindings quoted for on application. A few back numbers in stock.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

Disasters.

THE month has been one of much anxiety and of serious disaster, with the shadow of a still greater trouble over the mercantile marine. The Lund Line twin-screw steamer *Waratah*, of nearly ten thousand tons gross register left Durban for Cape Town on the 26th July with about three hundred persons aboard, being then in course of her regular voyage to London from Australian ports. Severe weather set in. But this should have made no difference to such a large and well-found vessel as the crack Lund liner, which was only on her second round trip. The distance between the two ports is but 800 miles. But no news came to hand of her and she did not put in her expected appearance at Cape Town. Other vessels arriving made reports as to having had their decks swept. So H.M. cruiser *Forte* was sent out to look for her. As she failed to find any trace of the vessel, the Natal steam tug *Harry Escombe* was also sent out, the cruiser *Hermes* and the Lund liner *Geelong* also joining in the search on the 12th August. It has been suggested that the main steam pipe might have burst in the heavy weather which undoubtedly was encountered by the steamer off Cape Agulhas, and that she might be drifting helplessly to the southward in the well-known Agulhas current, which runs at a speed of from three to four knots to the southward. Anxiety has been greatly deepened, and the case presents a desperate appearance.

The old Inman line, of course, gave us several instances of missing mail steamers. There was, for example, the *City of Glasgow*, which disappeared in the fifties, as well as the same company's *City of Boston*, which was never heard of again after leaving Halifax on her eastward voyage, not so far short of forty years ago. But these were all vessels of comparatively small tonnage and they were not fitted with the duplicated machinery of modern days. The largest steamer I can think of as missing was the White Star liner *Naronic*, which sailed from Liverpool towards New York on the 11th February, 1893, and was never heard of again, though one of her boats was picked up on the 4th March in that year by the s.s. *Coventry*, homeward bound from Norfolk, Va., in lat. 44 N. long. 45 W. On this voyage the *Naronic's* displacement was 10,290 tons, with a deadweight of 5030 tons aboard, including her coal. She was a comparatively new vessel—being only on her seventh voyage at the time of her loss—and was remarkable from the fact that she was the first vessel to be fitted with bulkheads according to the recommendations of the Bulkheads Committee, her owner, the late Mr. Ismay, having been a prominent and interested member of that Committee. Further, she had been built at Queen's Island by the firm of Harland and Wolff, and there could be no suggestion but that she was well found in every respect and one of the finest examples of shipbuilding of her day. Suggestions were made at the time that her stability might have been insufficient. But experiments made upon her sister the *Bovic*—still running for the White Star Line as a successful tramp liner—showed that this was quite an untenable theory, and the judgment of the Court of Inquiry simply affirmed that no probable reason could be put forward to account for her disappearance.

A case of the opposite kind—where the long overdue steamer was saved—can also be quoted. That was the *Waikato*, of the New Zealand Shipping Company, which became overdue when on her outward voyage after leaving the port of Cape Town. She was practically given up as lost, and the salving vessel, the *Asloun*, which had left the Thames after she became much overdue, herself got into the list, and reached a premium of twelve guineas for re-insurances before the news came that the two ships were making their way into Fremantle. The *Waikato*, though no longer of the fleet of the New Zealand Shipping Company, is still, I believe, afloat under the German flag.

Then came, off the same coast, the loss of the Shaw, Savill and Albion Company's liner *Maori*, which went ashore at Duiker Point, Cape Colony, within an hour of her departure from Cape Town on the 4th August. She struck at a few minutes before midnight in a very heavy sea, and the position was obviously one of extreme danger for those on board whilst quite hopeless for the ship herself. The crew consisted of fifty-five persons, the majority of whom left the wreck in three boats. Of these the chief officer's boat, with fifteen persons aboard, was capsized in the surf, and only nine of her occupants got ashore. The other two boats, with those who entrusted themselves to them, seem to have been lost altogether. When dawn broke on the morning of the 5th August it was seen that there were still fourteen men clinging to the rigging of the sea-swept wreck which lay only some thirty yards from the shore. Eventually a line was got out to the masts, but one man, who was forward on the wreck, unable to hold on any longer, tried swimming ashore and was instantly drowned. It appears that these men were asleep below when the order to abandon the ship was issued, and that they were unaware of the fact that their comrades were taking to the boats. As matters stand, however, they seem to have benefited by what took place, as a larger proportion of their number was saved than was that of the whole crew, for the remaining twelve men were rescued by the rocket apparatus from their position at the after end of the ship. There was, of course, no salvage of ship or cargo, the vessel going rapidly to pieces. This is said to have been the first total loss of a vessel of the Shaw, Savill and Albion Company in its long career. The *Maori* was a vessel of 5317 tons gross register, built in 1893 at Newcastle by Messrs. C. S. Swan & Hunter. She had a single screw.

A third important loss, happily unattended by loss of life, was that of the Houlder Line *Langton Grange*, a vessel of 5852 tons gross register, built in 1896 at Belfast by Messrs. Workman, Clark & Co. She was on her voyage from the Clyde to Newport, Monmouth, to load when, on the 4th August, she struck on the North Bishops, off the coast of Pembrokeshire, in fog. There was little hope of getting her off from the moment she struck, and at 6 a.m. on the morning of the 9th she parted amidships, her after end sinking in deep water.

The "Lusitania."

The new propellors of which I spoke in the last issue of these notes, seem to have already shown their effect on the speed of the big Cunarder. She arrived at New York on the early morning of the 23rd July, after averaging 24·33 knots during the voyage, in spite of bad weather at the commencement. But coming back she did even better, her daily average ran up to 25·17 knots, and the speed of her best day 25¾ knots. This seems to indicate an improvement of at least two-thirds of a knot owing to the change of propellers. On her August trip to the westward the *Lusitania* further improved her own record. Her best day's steaming was 655 miles, this being a speed of 25·77 knots. She totalled 2900 miles between Daunt's Rock and Ambrose Lightship, and averaged 25·65 knots on the whole passage. This is such a wonderfully even run that one is rather inclined to imagine that it is about the best she can do under the circumstances.

The "George Washington."

I have received abstracts of the Logs of three crossings by this new Nord Deutscher Lloyd liner. The first of these was an eastward trip commenced on the 1st July. The vessel accomplished the voyage between the Ambrose Channel light vessel and the Eddystone in six days nineteen hours and a quarter, averaging 18·9 knots. Her return trip towards New York took forty-eight minutes over the seven days from Cherbourg breakwater, the speed being 18·58 knots, whilst on the last eastward she took three hours and a half off her own last achievement and averaged 19·3 knots for the whole passage. This speed is remarkable considering that for which she was designed. She seems to be making a sea speed of from a half to three-quarters of a knot better than that which her builders promised for her.

The "Turret Bell."

One does not often hear of salvages in Canadian waters, and when they do succeed in floating steamers off those dangerous coasts it sometimes turns out that the salvors' labour has been practically wasted. But the floating of the Newcastle steamer *Turret Bell*, which went ashore on Prince Edward Island as long ago as the month of November, 1906, is a remarkable achievement enough. The vessel in question is valued at £14,000. She was built on the turret deck

system by Messrs. Doxford & Co., of Sunderland, in 1894, and is of 2211 tons gross register.

That the risk to which salvors expose themselves is not a mere nominal danger—to be spoken of amongst lawyers in the hope that the award may thereby be enhanced—is clear once again from what befell Messrs. Lambert Bros.' steamship *Plympton*, which stranded at the South-Western coast of St. Agnes Island in the Scillies in the middle of August. The vessel struck in fog, when on her voyage from Falmouth, where she had called for orders, towards Dublin, where she was to discharge her cargo of maize. She lay in a dangerous position on a ledge of rocks. But though the crew landed, and the vessel was considered to be in rather a hopeless condition, it does not seem to have been imagined that there was any immediate risk. Various islanders went aboard the wreck with a view to salvage. Suddenly, however, the ship slipped from her bed and turned over, throwing overboard and drowning two of the venturesome natives. The *Plympton* was a vessel of about 2800 tons gross, built at Hartlepool fifteen years ago by Messrs. Furness, Withy and Co.

The P. & O. Company.

The "great company in Leadenhall Street" is making certain important changes in its methods. Hitherto its trade has largely been with the well-to-do, or at least the more highly placed professional, classes. It has carried indeed two grades of passengers. But the second-class has been relatively small in numbers and for many years were treated somewhat differently from the intermediate passengers carried by the great Atlantic companies in certain important respects. They dined, for example, in the middle of the day and one knows of one's own knowledge that this one fact has been much objected to by certain members of the travelling public. Now all that is to be changed. Two of the 7000 ton vessels of their fleet are to be placed as extra steamers on the Bombay service and are to carry but one class of passengers, which is to be known as second-class. The dinner hour, too, is to be altered. This development is one which is sure to be appreciated, for the lines which have carried one class—whatever it may have been called—seem to have met the public needs. We have had, of course, the *Carpathia* of the Cunard Company, which has never carried any saloon passengers—what are technically called the second-class passengers having the best accommodation in the ship. I fancy, too, that the *Aurania*, of the same line, in her latter days, was changed to a second-class ship. Then we have other examples of one class in the Atlantic Transport Company which in its London and New York trade carries only first-class, and the White Star Line's Australian service, where all are held to be third-class.

The P. & O. Company is also disposing of a good deal of old tonnage. The single-screw cargo vessels *Formosa* and *Malacca*, which have for some time been in the hands of Messrs. Kellock's for sale, have just been disposed of to the Forth Shipbreaking Company. The two ships are sisters. They were built about fifteen years ago at Barrow by the Naval Construction and Armaments Company. They have triple-expansion engines and are of just over four thousand tons gross register. The *Malacca* will be remembered for many years to come in consequence of her experience during the course of the Russo-Japanese War, for she was the vessel which, whilst carrying munitions of war for the use of His Majesty's forces in the Far East, was seized in the Red Sea by one of the Russian Volunteer cruisers. A prize crew was put aboard her and she was taken into the Mediterranean again. There she was eventually released. But the proceeding was an entirely unjustifiable one and the compensation exacted by the Foreign Office from the offenders seems from all accounts to have been totally inadequate to the pecuniary losses actually sustained—to say nothing of the injury to P. & O. prestige and to the honour of the British flag.

A much more important vessel than either the *Malacca* or the *Formosa* has, however, been removed from the fleet in the *Peninsular*—an older, but larger, vessel built in 1888 for the Bombay mail service, by Messrs. Caird & Co., of Greenock. She is 5294 tons gross register and, like her sister, the *Oriental*, had fine passenger accommodation. She is transferred to the Italian register with a view no doubt to being broken up. There is also a report, but at the moment of writing I am not sure that it is accurate, that two of the four sister steamships built at the time of the late Queen's Jubilee for the Australian mail and passenger service by the P. & O. Company have also been sold to Italy. The four vessels in question were the *Arcadia* and the *Oceana*, built at Queen's Island by Messrs. Harland & Wolff, and the *Britannia* and *Victoria*, constructed by Messrs. Caird & Co. at Greenock. These vessels were of about 6500 tons each gross register. It is the two Clyde-built vessels which are reported sold. All the vessels named were, of course, single screws.

Wireless Telegraphy.

The loss of the Shaw, Savill & Albion Co.'s steamship *Maori* off the coast of Cape Colony and the disappearance of the *Waratah* in the same waters has turned public attention in South Africa to the desirability of fitting up stations with Marconi installations on their coasts. Wireless would, indeed, probably have been of little benefit to the *Maori* in her extremity, for the Board of Trade inquiry into the circumstances attending her loss came to the conclusion that she was driven ashore by heavy weather—a most unusual thing in the case of a high-class modern steamship, which is generally regarded as a thing which is above and beyond all danger from storm or tempest. But in the case of the *Waratah*, which was on what is practically a coasting voyage, there seems little doubt that communication with the land might have been of the utmost value. Moreover, the route along which the Cape steamers run in the voyage between England and South Africa is an ideal one for wireless telegraphy. It would be quite possible for them to be in touch with one or other station during the whole of their six thousand mile run. Signor Marconi, indeed, at a recent interview, explained his aims for the eventual covering of the globe with a network of wireless stations. From the fact that the great Australian mail steamers are now being fitted with installations we may indeed take it that on that route at all events it will not be long before communication is established, though, at first, it may well be that vessels trading in those waters will not be in continuous communication throughout the whole of their voyages.

The Nord Deutscher Lloyd

has disposed of further vessels from the older classes in its fleet. They are the three cargo and passenger steamers the *Bayern*, *Sachsen* and *Preussen*, sister ships built in 1886 at Stettin by the Vulcan Company at a time when that great organization had not yet achieved its now assured position as one of the most important shipbuilding yards in the world. The three ships are all transferred to the Italian register with a view, no doubt, to being shortly broken up.

The Union Castle Company

has secured the new contract for the carriage of the mails between this country and South Africa. The period covered will be either seven or ten years from the 10th September, 1910, when the present arrangement expires. An acceleration of transit will be effected so that the north-bound mail, instead of arriving at Southampton in the small hours of Saturday morning will at least be in in time for letters to be delivered in London on Saturday by the first post, and thus afford an opportunity of catching the outward mail of that afternoon.

MESSRS. JAMES POLLOCK & SONS & CO. LTD., have placed an order for a very elaborate teak cabin motor launch for service in Cuba. The dimensions of this vessel are:—Length 30 ft. by 7 ft. 2 in. by 3 ft. 3 in., and she is to be fitted with a petrol motor of 25 b.h.p. The fittings, cabin decorations, etc. are on a luxurious scale with electric light, etc., and, generally, when completed will show a typical example of the advancement of motor launch construction of recent years. The firm are also making a speciality of small steel boats, which are rapidly displacing craft built of wood, specially for tropical climates, owing to the trouble of keeping the latter tight and preventing the seams from leaking, and have recently shipped one to the West Coast of Africa, two to Cuba and several to South America, and have a number under construction at the present moment.

THE PORHYDROMETER.

Cargo Weighing.

WE have recently had an opportunity of seeing a demonstration of a new device called a Porhydrometer installed on a barge moored in the river Thames.

The Porhydrometer is an instrument designed for weighing with the utmost accuracy the dead weight placed on board or removed from any ship, barge or other floating vessel to which it is fitted. The instrument is based upon the principle that a body floating in a liquid of whatever density displaces a quantity of that liquid exactly equal to its own weight, and by the application of the device the vessel is transformed into a gigantic weighbridge or weighing machine. In the adjoining illustrations, Fig. 1 shows an enlarged view of the weighing mechanism, and Fig. 2 a model barge with apparatus fitted.

It will be understood that the tube being fixed in the centre of the vessel, neither transverse inclination nor change of trim will affect the accuracy.

It is claimed that the advantages to the shipowner, charterer and shipper include the following:—

The cargo is accurately weighed in one operation. The captain or officials in charge are at all times in a position to ascertain the weights on board. Coal taken at a coaling port can be weighed correctly. In various foreign ports it is well known that a full ton of coal is rarely, if ever, supplied. In Mediterranean ports, a shipowner rarely receives more than 15 or 17 cwts. to the ton. In case of leakage through collision, grounding or any other cause, the element of danger, and capacity of the pumps to cope with it, can be accurately gauged and the course regulated accordingly. By weighing total cargoes in one operation, or parcels of goods loaded or discharged by themselves, when they are completely placed on board, or taken from the vessel, a great saving in cost is effected, and consequently the loading or discharging can be carried out with very much greater rapidity, resulting in the reduction, if not complete avoidance, of demurrage. The amount of water in the ballast tanks can be checked if desired.

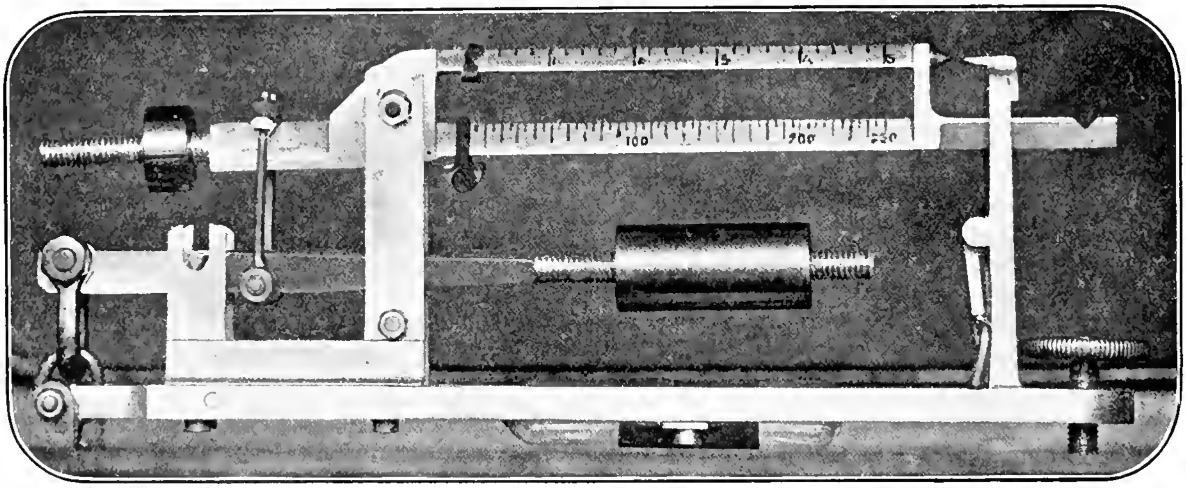


Fig. 1.

In the centre of the vessel a vertical tube is fitted extending from well below the light draught water line to well above the load line, and connected by a pipe with the outside shell of the vessel, so that when the valve or cock is opened the water in which the vessel is floating has free access to the vertical tube and rises in it to exactly the same level as outside the vessel, the water, both in the tube and outside the vessel, being thus of the same density. Inside the vertical tube is fixed a vertical float called the Aerometer, which, having exactly proportionate horizontal areas at the various immersions to the areas of the planes of flotation at the same draughts or immersions of the vessel, has an exactly similar displacement and reduces the enormous weights dealt with to a measurable quantity. The Aerometer, being immersed in the same liquid to the same extent as the vessel itself by its consequent exactly proportionate displacement, loses an amount of weight exactly equal to its displacement. This loss of weight disturbs the balance of levers of the weighing mechanism, and is exactly registered or counterbalanced by moving the weights along the steelyard, giving a correct reading of the weights placed on board the vessel, and *vice versa* weights removed.

We understand that the Porhydrometer can be fitted to any vessel of any type, whether large or small, or for sea, river or lake service, and as the cost of installation is small, it will pay for itself in a comparatively short period.

We have been informed that the Italian Government has tested the invention and has approved the same, and further, it has decreed that the Customs shall accept as correct the weight of cargoes measured by the Porhydrometer. This means that instead of a shipowner paying 23 centimes per ton for the Customs' weighing dues, he has only to pay 8 centimes, saving nearly 200 per cent. in Italian ports.

In the case of leakage, the Porhydrometer has attached to it an electric bell, so that when a leak is sprung a warning is given by the ringing of the bell. The fact of knowing the extent of a leak is of great importance to shipowners. Ships have been abandoned and lives have been lost on account of a

leakage not having been ascertained. This done, the Captain of a ship can calculate what port he can make and whether or not to abandon his ship.

The machine appears to be particularly useful for bulk cargoes.

Imperial International Exhibition, Engineering Day.—The Congress Hall at the Exhibition, Shepherd's Bush, is to be utilised on Saturday, Sept. 4th, for the reading of papers, and as the programme for the afternoon and evening promises to be both interesting and attractive, we give it for the benefit of our readers who may wish to take advantage of the opportunity of a visit to the Exhibition and hear one or more of the papers or see the machinery in connection with the various sections of the Exhibition, exhibits and side shows. The proceedings are to commence with a meeting in the Congress

The Porhydrometer. Fig. 2.

Hall at 2-45. The undernoted subjects will then be dealt with, illustrated by lantern views, except No. 4.

The Royal Drawing Society.

I. "Snapshot Drawing for Engineers and Architects," by Mr. T. R. Ablett.

II. "The simplest perspective drawing of machinery," by Mr. C. A. Ablett, B.Sc.

The Institute of Marine Engineers Incorporated.

III. "The extended uses of electricity on board ship," by Mr. John McLaren.

IV. "The treatment of marine boilers on long voyages," by Mr. H. Ruck-Keene.

Mechanical Engineers' Committee.

V. "Gas Engines," by Mr. Percy R. Allen.

VI. "Water Power and Turbines," by Mr. Alf. Steiger.

The Lord Mayor—Sir Geo. W. Truscott—will hold a reception on the Terrace of the Imperial Tower at 5 o'clock. The time at which each of the subjects enumerated above is to be taken will be published in the daily programme of the Exhibition; the arrangements, however, are to have the papers in connection with the Institute of Marine Engineers, Nos. III. and IV. to come on at 3.30, when No. III. will be introduced.

At 7-45 there will be a dinner in the Hall of the Garden Club: Tickets 5/- each for lady or gentleman. At 3 o'clock parties will be made up to inspect the engineering sections of the exhibits under the guidance of members of committee, divided out for each section with the details of which they are most conversant. The meeting-place for those desirous of seeing specially any of the following noted Machinery is the Terrace of the Imperial Tower, opposite the Congress Hall, which itself is at the Cascade. Visitors may choose which party they wish to join, designated by letter.

A.—Historic Automobiles and Aeroplanes.

B.—Mining and Metallurgical exhibits in the Machinery Hall

C.—Locomotive and Electric traction exhibits in the Machinery Hall.

D.—Petroleum Institute exhibits in the Machinery Hall.

E.—Printing exhibits in the Machinery Hall and the Daily Mail building.

F.—Smoke Abatement appliances and Gas Lighting plant in the Machinery Hall.

G.—Electrical plant for light and power in the Exhibition.

H.—Textile, Engraving, Pumping and other machinery in motion.

I.—Gas Engine plants, Refrigerating, Printing, etc.

J.—Architectural features of the Exhibition.

K.—Concrete construction of the Stadium.

L.—Design and Construction of building roofs and frames.

M.—The Construction and Operating mechanism of the flip-flap, spiral, toboggan, scenic railway, wiggle woggle, witching waves, whirling water, submarine railway, scenic aeroplanes, motor racing track, captive balloon, miniature railway, etc.

IMPERIAL MERCHANT SERVICE GUILD.—The August issue of the Guild Gazette is now before us and claims attention from a national point of view, as the advocacy of British seamen for British ships is one of the prominent features set forth in its columns. That our merchant shipping is to some extent manned by those who are not of our kith and kin is well known and is deplored by a large number who are deeply interested in the toilers on the ocean and the prosperity of our ocean traffic, with all the responsibilities connected with it, our dependence for food, as well as our hope and stay for defenders to meet the exigencies accumulating around us, and which may at any time become acute and require sharp with efficient action. There has been a considerable amount of agitation on the subject for some years. This has chiefly been of a controversial nature, with endeavours to apportion blame. Some of our own personal friends have been on opposing sides and our own position has been to quietly induce an improved feeling all round in order to discuss the question calmly and rationally on patriotic, as well as on economic, grounds. In our own immediate circle we know that good has resulted and it would appear that every one can exert an influence for good on both sides and effect an improved status and higher moral tone throughout the whole merchant service. The population of most of our large cities is composed to some extent of aliens, and we suffer it so to be, still the importance of our sea-borne traffic is such that it would be well to keep our ships manned by our own people. The evil exists—what is the cause, what the remedy? Shall another Dibden arise to stir the depths and awake the echoes? The Gazette contains a large amount of information relating to matters of importance to all connected with ships and shipping, pointing out where justice has been done and claims met under circumstances which otherwise had contributed to hardship.

Life-Saving Appliances.—The *London Gazette* of August 13th contains Orders in Council to the effect that the provisions of Sections 427 to 431 of the Merchant Shipping Act, 1894, relating to life-saving appliances, shall in future not apply to German or Norwegian ships while within any port of the United Kingdom, if it is proved that the provisions relating to life-saving appliances laid down by their respective countries have been complied with.

ONE-LOCK ADJUSTABLE REAMER.

GREATER accuracy of workmanship is to-day demanded by modern engineering practice, and, while the limit of manual dexterity has been reached years ago, the line of development lies in the direction of greater refinement in tools in order to obtain the standard of efficiency. In all probability one of the most expensive and difficult operations is the production of an accurately dimensioned hole in multiple. The capital sunk in solid standard reamers in an ordinary engineering works of average size must be considerable, and any change in size from standards must involve large expense; there is consequently a real want for a thoroughly reliable adjustable reamer.

A tool of this description has been put on the market by Messrs. Vickers, Sons & Maxim, Ltd., of Westminster, which we have pleasure in illustrating and describing. Referring to the illustrations, Fig. 1 shows the complete tool, Fig. 2 shows the component parts ready for assembling, Fig. 3 is a part front elevation and part section, showing how the adjustment of all the blades is simultaneously effected by rotating the cam bolt, and Fig. 4 shows how the blades are secured in position by the cam bolt.

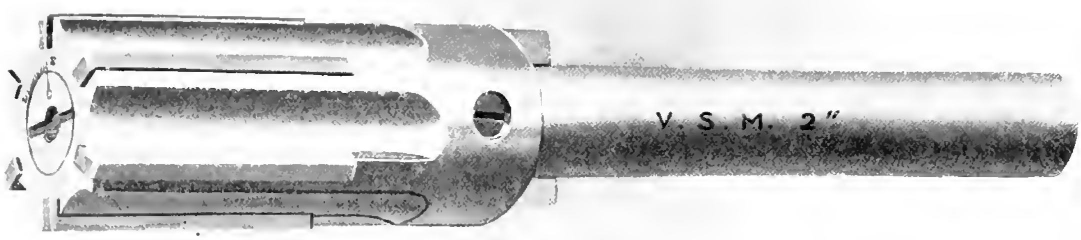


Fig 1

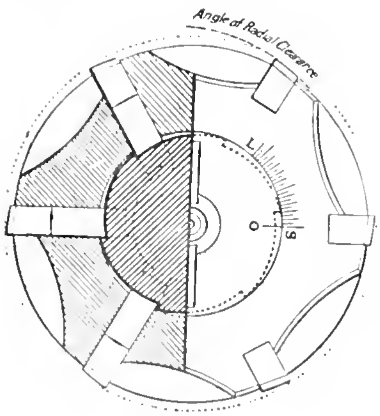


Fig. 3.

The reamer proper consists of only three parts in addition to the blades, *viz.*, the shell, the cam bolt, and the lock nut. In addition to these parts there is the arbor (either parallel or morse taper) for supporting and driving the shell, the key for adjusting the reamer from the front end, and the box spanner for locking the adjustment when so made. The number of blades to each shell varies with the size of the reamer, but this number is always even, so that a micrometer or other measuring instrument may be used for ascertaining the size to which the reamer is set.

The shell is made in one piece, as shown on the right of Fig. 2, and is bored and slotted to receive the cam bolt and the blades. The cam bolt, shown on the left of the same illustration and in Fig. 3, provides the means for adjusting the blades. Around its circumference is arranged a set of cams in somewhat the form of the teeth of a ratchet wheel, one cam for each blade.

The blades have their cutting and inner edges ground exactly parallel to each other, and the latter rest on the ratchet-like surfaces of the cam bolt. A projection of the inner edge of each blade engages with an undercut recess on the cam bolt, holding the blade rigidly against the hardened cam surface; this is clearly shown in Fig. 4.

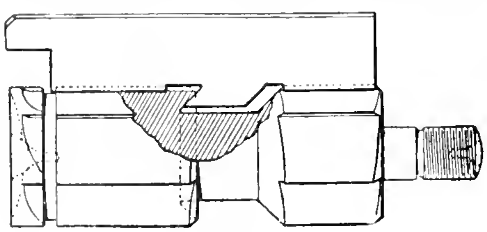


Fig. 4.

On the front of the cam bolt is marked a zero line, and on the shell there are graduations to preserve the setting, as shown in Fig. 3. The other end of the cam bolt is fitted with a nut lying within the recessed upper end of the shell, which, when tightened with the box spanner, positively locks the adjustment of the blades.

When adjusting the reamer, the cam bolt is revolved by inserting the key in the slot at the end, the blades

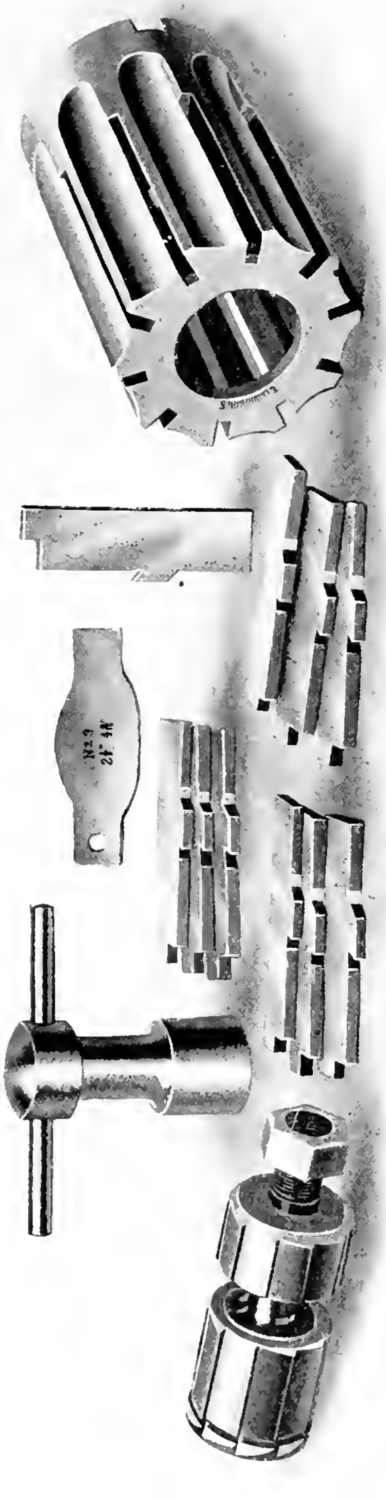


Fig. 2

are forced outwards by the cams, and the effective diameter of the reamer is thereby increased. Reversing the operation draws the blades inwards, but before tightening the lock nut, it should be ascertained that all the blades are actually bearing on the cam bolt.

The Petroleum Institute.—An address was delivered by Dr. Dvorkovitz, principal of the Petroleum Institute, in the hall of the Garden Club at the Shepherd's Bush Exhibition on July 23rd, when there was a good attendance of ladies and gentlemen to listen to the lecturer, who, in the course of his address, gave some interesting notes on the history of the petroleum industry, with a few preliminary comments on the probable origin of fire worship—fire the refiner and purifier, as well as the giver of light. The use of petroleum—a natural product direct from the earth—has been known for ages in the lands where it is found in rich abundance, not only for lighting, heating, lubricating and similar purposes, but for its medical properties and curative action. Petroleum is found in widely distributed fields, north, south, east and west Siberia, Mexico, Burmah, Pennsylvania, etc. Akin to petroleum is the shale oil which has been produced in Scotland and manufactured into a variety of uses with considerable success for many years. The necessity of a thorough good education and training of experts to carry out investigation in connection with the petroleum industry was made manifest as the lecture proceeded. The value and probable extent of the crude material require to be carefully considered by the prospector whose knowledge of geology and chemistry come into operation in determining the factors which bear upon his report and recommendation whether the field from an investor's point of view will likely prove remunerative or not. The question of surroundings and proprietary rights, with possibilities of complications arising out of budget proposals and tariff or protection duties have also a bearing on the subject, a knowledge of the history and geography of the situation here has place and it is more difficult to exercise a wise discretion in forecasting the probabilities of what hindrances and consequent expenses may arise after operations are started and when it is to determine the prospects from eventualities depending upon the stability or caprice of nations, rather than to sum up from known data what results are likely to follow in the natural order. The means of transit to a seaport is a consideration, which engages the engineering instinct and the possibilities of lines of pipes with gravity and pumps to carry the oil from the wells to the storage tanks and to the vessels at the exporting harbour. Beyond these questions are the considerations of the most marketable of the products in their manufactured state ready for use. The art of the chemist is brought to bear upon the subject and the crude oil is treated for its various uses, whether for lighting, heating, lubricating or combustion for power producing. The erection and management of refineries with the most desirable location for these require careful attention, while the blending of oils for lubricating purposes, light and heavy shafting, high temperature resisting quality for internal steam service and low temperature resisting quality for refrigerating machinery forms a very important section in the management of the refinery. After the address tea and coffee were served to the visitors. An adjournment was then made to the Machinery Hall to inspect the exhibits of the Petroleum Institute, an educational establishment for training experts in the petroleum industry. The geological section of the exhibit comprises maps and diagrams showing the oil fields of the world, chief of which are those of Russia, Roumania and California; collections of strata through which the borings are pierced to the oil wells, from different districts, and the depths of the borings necessary in each case. The mechanical section shows the drilling apparatus and machinery. The section which embraces samples of crude and refined oils from different wells all over the world is of great interest showing the great range of material from the light benzine to the heaviest lubricating oils. Specimens of oil lamps of the most modern make are also on view, including incandescent lamps of nice appearance and of great economy. Liquid fuel apparatus and burners and carburetters are shown in an adjoining case. Apparatus for testing petroleum and oil of various grades, models of refineries, tanks, steamer railway waggons, etc., complete the collection which is worthy of close study by those who are interested in the subject.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondent.*)

Portsmouth Dockyard.

The Royal review on July 31st went off splendidly. Though it was only two years since the King had reviewed his fleet, many changes had taken place in that time, and His Majesty was no doubt as much interested in the *Dreadnoughts* and *Invincibles* as were his subjects. Elaborate precautions were taken to protect the Czar and Czarina during their stay, torpedo boats and pinnaces having been told off to patrol the vicinity of the Royal yachts day and night. The review did not pass off without a mishap, for while firing the Royal salute on board the *Téméraire* from a 4-in. gun an accident occurred by which three men were seriously injured, one of whom afterwards died in Haslar Hospital. During the stay of the fleet at Spithead the *Russell's* picket boat was returning to the ship with the captain on board when she was run down by the picket boat of the *Hindustan*. Although the *Russell's* boat managed to get alongside the ship, she sank before the slings could be hooked on, but was recovered next day. Strenuous efforts are being made with the *Neptune* to make up for the time lost by the non-delivery of some important castings for the stern of the ship nearly four months ago. Men are working day and night shifts, and good progress is therefore being made. She is to be launched on September 30th by the Duchess of Albany. The completion of the *St. Vincent* will be delayed for quite three months owing to the strike on the East Coast last year, which affected the completion of her machinery. A sad accident occurred on board the cruiser *Forth*, the seagoing depot for the submarines attached to this port, on July 30th. It appears that the boilers were being connected up when a sudden rush of steam came from a main pipe in the stokehold. Four men escaped more or less badly scalded, but Engine-room Artificer Moses was almost instantaneously killed. Engineer-Lieutenant Wolfe attempted to enter the stokehold, but was driven back by a rush of steam. Donning a smoke helmet, he made another attempt, but was again driven back, this time so overcome that the crew had to play the hose on him to bring him round. Steam was still rising from the stokehold, but again he went down and found Moses dead. At the inquest the jury expressed their admiration of Lieutenant Wolfe's gallantry, which the coroner endorsed. The cruiser *Hermione*, of the Third Division of the Home Fleet, ran aground in the Humber shortly after midnight on August 6th, when returning from an attack on Paull Battery. All her shells were taken out to lighten her and next morning six Hull tugs succeeded in getting her off at high water. She subsequently came back here and was docked, but the damage appears to have been very little. The mobilization of the military defences towards the end of July concluded with an attack by destroyers, which was attended by a fatality and a collision between torpedo boats. A seaman was washed overboard from the *Lightning* and drowned. The collision, which was between torpedo boats Nos. 13 and 10, was remarkable in that the former vessel did not sink at once, for she was cut down amidships from the deck to far below the water line. Her engine-room and stokehold were flooded and the fires put out, but the water-tight bulkheads kept the vessel from sinking. Assistance was immediately rendered and the damaged boat was lashed alongside torpedo boat No. 20, which, with the torpedo gunboat *Niger* in attendance, proceeded into harbour. The damaged vessel was docked, when it was seen that the plating had been torn off a large portion of the ship abreast the engine-room. A considerable amount of water must have been shipped, as the vessel had only about eighteen inches of freeboard. The battleship *Hindustan* came into harbour on August 4th for repairs, which will detain her until the middle of September. The ease with which the destroyer *Ferret* cut her way through the boom on July 28th was quite a surprise. The vessel was strengthened by having ordinary steel plates fixed on either side of her bows, and afterwards upon examination of her hull it was found that she had sustained no damage. Doubtless before long the boom will be improved upon and there will be further experiments. Engineer Rear-Admiral Corner retired from the post of manager of the engineering department on August 16. He had been here nearly thirty years, and for the last twenty-one years he had been head of the engineering department. For thirteen years he was a member of the Admiralty Committee of Reference for Machinery Designs, and he also served on Admiral Buller's Machinery Committee. His successor is Engineer Rear-Admiral Sanders, who was promoted to his present rank in March last. He has just been awarded a good service pension.

Devonport Dockyard.

Very satisfactory progress is being made with the construction of the cruiser *Indefatigable*, which is to be launched during the last week of October. Her bow will be very lofty and greater in height from the blocks than any vessel previously built at this yard. The weight of material now built into her is over 4,000 tons and her launching weight will be about 6,500 tons. Another vessel will be laid down on the same slip by the end of November. The battleship *Collingwood*, which was laid down in February of last year and launched in November, will probably be delayed two months in completion owing to the strike on the East Coast last year. The battleship *Commonwealth* is undergoing the triennial examination of her internal compartments and armament fittings. The torpedo gun vessel *Hebe* is being reboilered, and she is also having her equipment remodelled, in addition to being provided with wireless. She has been selected to act as sea-going depot ship of the Northern Division of Submarines, and will have her headquarters at Dundee, where a submarine base is in course of formation. The old battleship *Howe* is being repaired for sale. All her gun fittings that are likely to prove useful are being unshipped and her four 13·5 inch guns dismounted. The torpedo tubes, which will be sold with the vessel, are being mutilated. Engineer-Commander Emdin, who recently relinquished his appointment as senior assistant to the engineer manager, was entertained to a farewell dinner on July 29th by Engineer Rear-Admiral Wishart, the manager of the engineering department. The dinner took place at Admiral Wishart's official residence, and a large number of officers were invited to meet Commander Emdin, who, the following week, joined the battleship *Commonwealth*. A couple of months ago reference was made to what will be the last prize gathering at the Royal Naval Engineering College. The last number of the "R.N.E. College Magazine," which has just been issued, is especially interesting, as it is the last number to be issued under the old *régime*. It contains a record of the doings of the past year and a very well-written poem entitled "Farewell." Work was done in the yard by the cadets during the year on the *Andromeda*, in which they overhauled the boat and coal hoists, ventilating fans and capstan engines. Afterwards work was done on the cruiser *Niobe*, while a few of the cadets were engaged on the *Doris*. The result of the final examination for third-year students in naval architecture at the Royal Naval College, Greenwich, has just been published. Messrs. Wall and Cannon, who occupy the first and second positions, began together as apprentices in this yard. They have kept pace with each other in a remarkable manner, passing after four years in the dockyard schools and a year at the local technical schools, to the Royal College of Science by means of national scholarships, and thence by Admiralty and Royal School of Naval Architecture scholarships, to Greenwich. The results of the competitive examination of candidates for entry as dockyard apprentices and boy shipwrights are also very satisfactory. Devonport boys have done splendidly, the boy who was at the top of the boy artificers' entry list also heading the apprentices' list with a total of 1,327 marks out of 1,500, while the lowest successful boy at this port obtained 1,053 marks. It is interesting to note that the number of marks by the top boy and the lowest successful candidate at Hauthowline was 979 and 697.

Chatham Dockyard.

On August 9th, Vice-Admiral Giffard, after holding the post of Admiral-superintendent for two and a half years, handed over the command to Rear-Admiral Ommanney. Apart from dockyard matters Admiral Giffard and his wife took

a prominent part in many charitable institutions in the district, and their departure is naturally much regretted. Joining the yard when the outlook was not at all bright, Admiral Giffard strove hard and brought the establishment up to its former level. The yard has never been in a more flourishing condition and its reputation has been fully maintained. Captain Ricardo, who had been in command of the battleship *Russell* in the Atlantic Fleet for the past two years, and Captain De Salis, our deputy superintendent, exchanged commands at the end of July. Captain Ricardo just had time to settle down to his duties before the arrival of his new chief, Rear-Admiral Ommanney. Captain De Salis, who will take the *Russell* to the Mediterranean, had held the post of King's harbourmaster and deputy superintendent for two years. He was only a short time ago appointed an Aide-de-Camp to the King. The same distinction has been conferred on Commodore Troubridge, who is in command of the Royal Naval Barracks. Somewhat unexpectedly the repairs to submarine C 17, which was damaged in collision in the North Sea on the night when C 11 foundered, are being carried out here instead of at Sheerness, where she was first docked. Her sister vessel C 18 has gone round to Portsmouth, where she has been commissioned by Lieutenant-Commander Halahad, who was in command of C 17. The other two vessels of the class, C 19 and C 20, are in an advanced state. The cruiser *Apollo*, which has been converted at a cost of £23,000 into a mine-layer, was commissioned on August 4th by Commander May for service in the Third Division of the Home Fleet at Devonport. She was manned by a crew from that port, but the vessel will not leave here until early in December. The *Shannon*, flag ship of the Second Cruiser Squadron, came in for docking at the beginning of August, but she only remained long enough to give five days' manœuvre leave to her crew in two watches. The new turbine torpedo boats Nos. 34 and 35 have arrived on delivery from their builders and have been commissioned for service in the Nore Flotilla, which will eventually consist of twelve of those vessels. Instructions have been received that the last six of the first batch of ocean-going destroyers—the *Afridi*, *Viking*, *Maori*, *Zulu*, *Crusader* and *Nubian*—are to be commissioned with crews from this port on delivery for service in the First Destroyer Flotilla, in which they will replace six of the "River" destroyers. When the changes have been carried out the flotilla will consist of twelve vessels of each class, ocean-going and "River."

Sheerness Dockyard.

When the Nore contingent of the First and Second Divisions of the Home Fleet were in port the harbour presented a busy appearance. The ships only stayed to give five days' manœuvre leave in two watches. They then left, some for Bantry to calibrate, others for the Longsands for gunlayer's tests, and the remainder for Cromarty for battle practice. Captain Moore, who since December last had been in command of the *Dreadnought* and chief of the staff in the Home Fleet, has received a new appointment. He is now "captain of the fleet," with the rank of first-class commodore, while Captain Richmond, who had been serving in the *Dreadnought* on staff duty, has become flag-captain to Admiral Sir William May. Captain Moore, it is worthy of note is the only officer in the service ranking as first-class commodore, and he is junior to three captains who are second-class commodores. The *Dreadnought* will, it is anticipated, be succeeded in April next as flagship by the *St. Vincent*, now completing at Portsmouth. On the dispersal of the fleet at Cowes several of the destroyers of the First Flotilla came in for docking, including the *Cossack*, *Ettrick*, *Erne*, *Ribble* and *Nith*. The latter vessel was passed out of hand on August 16th and rejoined the broad pennant of Commodore Charlton at Harwich. The *Ribble* and *Ettrick* will leave for Scotland, whither the flotilla has gone, on completion of their refits. The scout *Pathfinder*, of the First Flotilla, being in dockyard hands at Chatham, her sister scout, the *Patrol*, is temporarily taking her place. The *Patrol* was to have been relieved in the Nore Flotilla on the delivery of the ocean-going destroyer *Swift*, but the order was cancelled and the *Swift* was directed to join the flotilla as an additional ship. On August 6th submarines C7, C8 and C9 came in for a refit. At the time of writing operations are still going on for the salvage of C11. On August 11th the tug *Robust* left with No. 79 lighter, and the *Diligent* followed next day with the 500-ton oil fuel lighter C122, which has been specially fitted with appliances for lifting the submarine. Reat-Admiral Ommanney, the new superintendent of Chatham Dockyard, is in charge of the operations. Admiral Sir Charles Drury, the Commander-in-Chief at the Nore, has paid two or three visits to the scene of the disaster. The damage to Submarine C17 is being made good at Chatham instead of here, owing to the fact that we have only one dock available for this class of boat, and that is usually occupied by some of the vessels of the Nore flotilla. A collision occurred on August 10th below the Nore between torpedo boat No. 074 and an empty collier named the *Vane Tempest*, of Sunderland. The boat was cut into from the upper deck to the keel, and but for the resistance offered by an iron bar and the bow torpedo tube she would probably have been cut in two. A stoker was knocked down by the force of the impact, but fortunately he was only slightly injured. The boat steamed back to harbour and was taken into dock, while the collier, which received no injury, proceeded on her journey. Torpedo boat No. 35 arrived on August 7th from Palmer's Shipbuilding Works, Jarrow, and two days later went up to Chatham to be commissioned. No. 36, the last of the series, has not yet been delivered. When she arrives, the Nore Division will have attached to it one-third of the force of torpedo boats which were at first described as coastal destroyers. The Portsmouth flotilla of twelve boats is complete, as is also the Devonport flotilla. Captain Johnston Stewart, our captain-superintendent, is now at the top of the captains' list, and will reach flag rank in a very short time, probably before this appears in print. He succeeded Rear-Admiral Casement in July of last year, that officer vacating on promotion. It is not anticipated that Captain Johnston Stewart will leave immediately he is promoted, he will probably remain a few months longer.

Pembroke Dockyard.

A rumour has been in circulation that the Admiralty have decided to place an order for a large cruiser at this yard. It no doubt originated from the fact that measurements were recently taken officially at No. 1 building slip, the shed over which has just been demolished. The measurements were taken in view of the erection of four iron masts at the side of the slip. They have been brought here to be put up and fitted with gaffs, so as to be used for placing material and fittings on board ships building, and should prove very handy and convenient. The intention is to lay down the *Blonde* on the slip but nothing is known as to the construction of a larger cruiser. The foremast and mainmast of the *Bellona* have been lifted into the ship and altogether she is making splendid progress; indeed, by the time these lines appear in print she will probably be dry docked. The *Blanche*, too, is proceeding apace. The basin trial of the destroyer *Violet* was carried out with satisfactory results. In addition to having her boilers retubed and her engines overhauled and repaired, she was fitted with a new stem and also replated at the bow. On her recommissioning trial there was a breakdown with the ventilation fans and the trial had to be repeated. This having been carried out satisfactorily she was accepted for service. A remarkable incident occurred during the trial. A sea struck the vessel, damaging the navigating bridge and washing a man overboard, but another wave washed him back. He was unconscious, but one of his shipmates managed to grasp him by the leg and hold him, and when he recovered consciousness he was not much the worse. The *Violet* has now gone to Devonport and joined the flotilla at that port. The refit of the *Osprey* is being pushed on. Like the *Violet* she is fitted with three Thornycroft water tube boilers, which are to be retubed. In addition to this, the main propelling and auxiliary machinery is to be opened out and renovated. The result of the entry examination for dockyard apprentices leaves much to be desired as far as Pembroke is concerned. Our first boy only obtained 1,023 marks out of 1,500, as compared with 1,327 obtained by the first successful boy at Devonport. The number of apprentices to be entered here is twenty-four, their average marks being 889, while the average of the first twenty-four boys at Devonport was 1,203. The ninety third Devonport boy obtained more marks than our first boy. It is to be hoped that things will improve in this direction before many years.

THE LATE MR. JAMES DIXON.

(PRESIDENT, INSTITUTE OF MARINE ENGINEERS)

It is with deep regret that we have to record the death of Mr. James Dixon, Chairman of Lloyd's Register of Shipping and President of the Institute of Marine Engineers, which took place at his residence, at Sevenoaks, on July 28th, after a long illness.

Mr. Dixon's interests were many and varied; shipping, the coal trade, marine insurance, and other departments of business life each claimed a share of his attention, and upon all the enterprises with which he was connected he brought to bear high intellectual abilities and an energetic progressive spirit which marked him out for distinction and ever made for success. He was born in the year 1849, and after completing his studies at Eton subsequently widening his outlook upon life by extensive travel he began his life-long connection with the business activities of the City of London, the early years of his career being successfully devoted to the development of the business of Messrs. Harris and Dixon, Ltd., shipowners, from which firm he only retired a few years ago. Since 1878, when he became a Member of the Committee, he had been intimately associated with the Society of Lloyd's Register of Shipping, of which Society, on the retirement of Sir John Glover two years ago, he was elected Chairman. He was an underwriting member of Lloyd's since 1886, and joint managing director of the British Steamship Investment Trust, and was also a director of the Millwall Dock Company, whose property is now absorbed by the new Port of London Authority. Although not directly associated with engineering, his generous tribute to the worth and value of the marine engineer, given in his speech on the occasion of the annual dinner of the Institute of Marine Engineers in 1907, is an evidence of the wideness of his sympathies, and it is further to be remarked that it was on his suggestion on that occasion, and mainly through his efforts, that the Lloyd's Register Scholarship in marine engineering was established in connection with the Institute. Mr. Dixon's counsel in all matters pertaining to shipping was much valued, and he filled important positions in various societies which help to preserve the maritime eminence of this country. He was Chairman of the Shipowners' Society, a past President of the Chamber of Shipping of the United Kingdom, President of the Institute of Marine Engineers, and an Honorary Vice-President of the Institution of Naval Architects, for which institution he also held office as Treasurer.

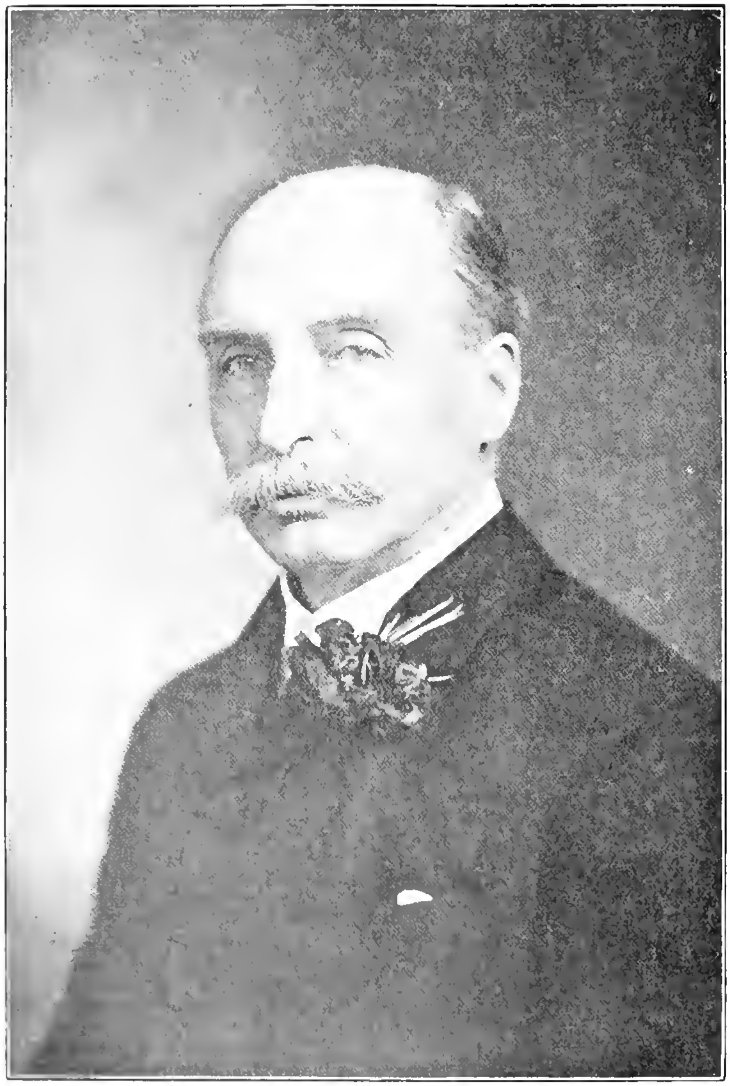


Photo by Elliott & Fry

The late Mr. James Dixon

Courteous and considerate without sacrificing his firmness of character, generous without being ostentatious, Mr. Dixon was universally esteemed. Outside the circle of his bereaved relatives, to whom we extend our heartfelt sympathy, his loss will be felt in many directions through the cessation of many wise and generous actions which tended to the common good, and helpful words of counsel on which reliance could always be placed.

NEW DREDGER.—An order has been placed by Messrs. James Pollock, Sons & Co., Ltd., for a special type of dredger for shipment abroad. This vessel has to deal with sand banks which have been piled up in shallow rivers by the action of a strong current, the said banks causing at times the overflowing of the river banks and much damage to crops at certain times of the year, a state of affairs experienced at many remote parts of the world. The complete dredger will be so constructed that it can be bundled in small parts for going up country and over rapids, in fact, it will be a unique craft altogether.

INTERCOSTAL SIDE STRINGERS IN MODERN STEEL VESSELS.

LIKE some other parts of modern vessels, side stringers came to be fitted as a continuation of the practice which had been current in wood shipbuilding. When the transition took place from wood to iron it was inevitable that the ideas of the shipbuilders who effected that transition, should be influenced to a very large extent by the practice and precedent which had for so long been established in respect of wood ships. Accordingly, we find transverse frames of iron taking the place of the old transverse timbers, and in place of the shelves and stringers which were disposed longitudinally to fix the relative positions of these timbers, it seemed natural to fit some form of longitudinal girder which should fulfil the same function—side stringers and keelsons. Although it may be inferred that side stringers came into being in this somewhat arbitrary manner, yet the custom of fitting them has persisted till the present day, not without great changes having taken place, however, from their original forms. Indeed, no other part of a steel vessel has been subject to such changes, or has been the subject of so much discussion. Within quite recent times the materials used in these parts of a vessel's structure have been very considerably reduced, and as discussion still goes on with reference to their utility, it appears to be appropriate to consider briefly, first, the necessity or otherwise of intercostal side stringers amidships; and second, granting their necessity, how they may best be compensated for if it is desired to dispense with them.

Now we shall not make much headway with either problem unless we have a clear idea of the functions which side stringers are supposed to perform. If we consult text-books on the subject we shall find that they are credited (1) with contributing a certain amount of longitudinal strength, (2) with preserving unaltered the relative positions of the frames, preventing them from tripping, (3) with affording intermediate support to the shell plating. The first of these we may dismiss altogether. The amount of longitudinal continuous material now employed in side stringers, and their proximity to the neutral axis, renders their assistance to the longitudinal strength of the vessel very slight indeed. But there is no doubt that they do prevent the frames from tripping, and that they stiffen the plating locally, and it remains to enquire whether the frames and plating require such assistance. If we knew quantitatively the stresses which come upon the shell and frames the problem would be comparatively simple, but, of course, we do not know these stresses. As regards tripping, however, a very interesting comparison is available from what we know of the behaviour of deck beams. Ships can be built, and have been built exceeding 45 ft. in breadth with the deck beams fitted to alternate frames, say 4 ft. apart and supported at the centre by one row of pillars. Taking into account the spacing of the beams, the height of 'tween decks, and the nature of the cargo known to have been carried, it may be assumed that there is a fairly close correspondence between the stresses on the beams and those coming upon frames. Yet for a length exceeding 20 ft. there is no provision made for preventing the beams from tripping, and it is found, moreover that they do not trip. Beams are, indeed, amongst the most satisfactory parts of vessels in this respect that very few cases of failure have occurred due to normal loading. And if our experience of beams has been so satisfactory even under the conditions as described above, it is fair to assume that, in the case of the transverse frames, of less unsupported length no provision is necessary to prevent lateral deformation.

With regard to the local support to the side plating the presence of side stringers is easier to understand. If we take a frame space of plating with no intercostal stringers fitted, we know that for the most part the pressure on this space is transmitted by the plating to the frames, and that in doing so, the plating is subject to normal stresses due to bending between the frames, and to ordinary "pull" stresses due to the deformation and consequent elongation of the plate. It would be easy to show that in a long narrow space such as we are considering with no stringers fitted, the stresses on the plating at the frames are at a maximum and those at the horizontal supports are at a minimum. The introduction of more longitudinal supports, in the form of intercostals has the effect of reducing the stresses on the plating at the frames, and also of reducing the shearing stresses on the rivets connecting the shell plating to the frames. We must remember, however, that the side plating in ordinary cases is of substantial thickness, that it is not reduced on the sides as it might be from purely theoretical considerations, and that it is of substantially the same thickness as the bottom plating, for example, which is subject to additional structural stresses of considerable magnitude. The thickness of plating fitted on the side of a vessel amidships in the proximity of the neutral axis cannot be conceived to have more to do than the plating at the ends of the vessel, and yet it is substantially thicker than the plating at the ends. When to this we add the knowledge we have of the immense loads at which rupture of plating of this thickness takes place it does not appear that any additional support is required. From general considerations, such as the above, therefore, we do not consider that in ordinary cases, such as we have been considering, intercostal side stringers are essential parts of a vessel's structure amidships, and this belief is supported by the experience (somewhat limited, it is true) of vessels built without side stringers in which, so far as is known, no evidence of failure has been detected.

It may freely be admitted, however, that these considerations do not appeal to everyone and that there are many naval architects who still believe in the necessity for fitting intercostal side stringers in cargo vessels. There are many shipbuilders to whom the expense and increase of weight attendant upon fitting them are repugnant, and who therefore wish to dispense with them and to fit adequate compensation. There are also many owners who wish them omitted to suit the requirements of their particular trade. To all these, therefore, the question of compensation is of interest. In the past stringers have been dispensed with and some increase made to the depth or thickness of the transverse frames. This is quite a logical proceeding if the object is to make the frames stronger against tripping for the stringers themselves cannot have the slightest appreciable effect in adding to the *transverse* strength of the frames. If compensation must be fitted, it had much better take the form of some increase to the thickness of plating in way of the omitted intercostals associated with a slightly closer spacing of the rivets connecting the frames to the shell plating. In all cases this would involve a saving of weight and certainly a very considerable saving of labour. This saving would be a gain to both builder and owner, without, so far as can at present be seen involving any appreciable reduction of the general efficiency of the vessel. It need hardly be pointed out that the above remarks are only intended to apply to ordinary cases. They are not intended to apply to cases where wide frame spacing is adopted, or, where as at the ends of a vessel special circumstances have to be taken into account.

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Messrs. Leonard Chapman & Co., importers and manufacturers, Munton Road, London S.E., report Graphite as imported according to quality:—

Ceylon L.L. c.i.f. London £30 0 0 to £45 0 0 per ton
" O.L. " 10 0 0 to 40 0 0 "
" chips " 13 0 0 to 33 0 0 "
" dust " 8 [illegible] 0 to 30 [illegible] "

Purified, milled and ground
Ceylon, 97% to 99% f.o.b.
London 50 [illegible] to [illegible] per ton
" [illegible] to [illegible] " [illegible] to [illegible] "
" 80% to 81% " 30 [illegible] to 3[illegible] "
" 75% to 71% " 27 [illegible] to 28 [illegible] "
American large flake f.o.b.
London 45 [illegible] to 49 [illegible] "
" small " 40 [illegible] to 45 [illegible] "
Graphite Joint Compd. 2 [illegible] to [illegible] per cwt
Graphite Paint Paste " 2 [illegible] to [illegible] "
Graphite Paint " 0 4 6 to [illegible] per gal

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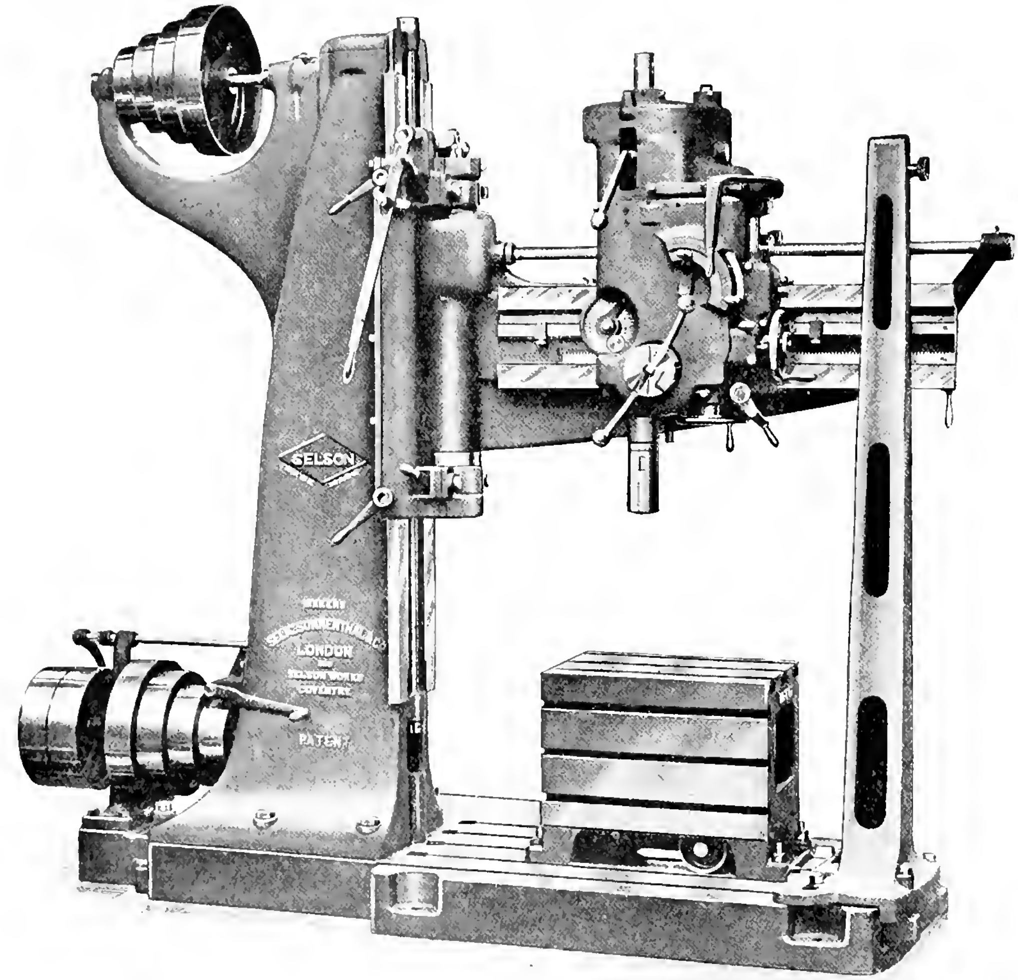
THE "SELSON" HIGH-SPEED RADIAL DRILLING MACHINE.

So much work is done in these days by means of rotary motion that it is necessary to bring up standard drilling machines to comply with the increased requirements of this class of tool.

In the machine illustrated in the adjoining diagram, which has been specially built for use with high-speed drills and heavy feeds, several novel and interesting features are embodied.



One of the many advantages this machine possesses over others of the trunnion type, is that the overhang of the spindle from the column is reduced to a minimum without sacrificing the length of the vertical slide. In other known makes of machines, either the vertical slide bearing on the column is too short to avoid a considerable deflection under heavy feeds, or is continued to a considerable distance below the point of the drill, thereby reducing the diameter of tall pieces of work, and in consequence the capacity of the machine.

The vertical slide has long guiding surfaces on the column, in order to avoid deflection when the drill is worked at the outer end of the arm. The traverse can be easily and instantaneously disengaged at any desired point, by means of a hand lever placed in a convenient position on the slide, and a special safety device is also provided for automatically defining the limits of traverse in either direction.

This device consists of a lever connected to the clutch for operating the elevating nut and two fixed stops on the column. Should the attendant through negligence not disengage the operating gear before the slide has reached the end of its traverse, the lever strikes one of the stops, and disengages the operating clutch. The arm is of box formation and is mounted on ball bearings so as to swing through an angle of 180°. The spindle is driven direct or through the double gearing, the handle for operating the back gear as well as the one for reversing the direction of the spindle when tapping being placed upon the carriage.

Both these motions can be effected without stopping the machine and taps can be withdrawn at a rate of $4\frac{1}{2}$ times quicker than the speed of tapping.

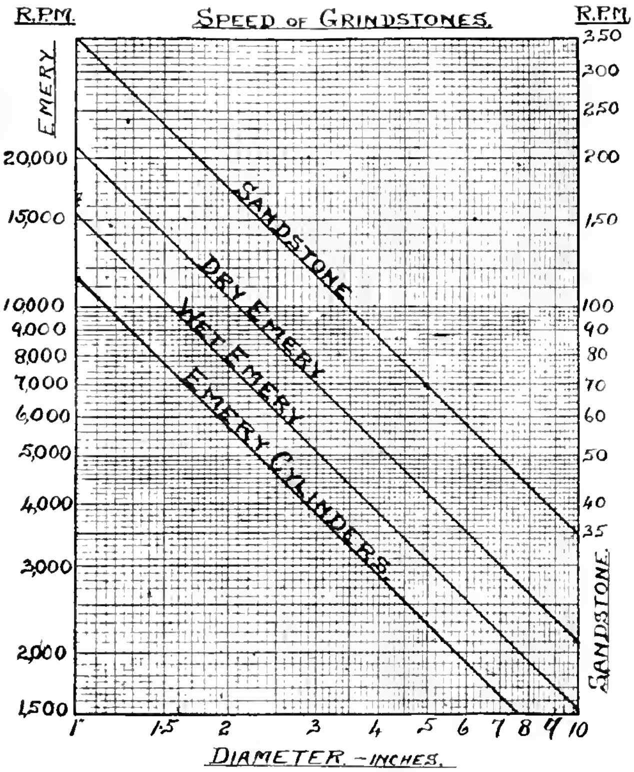
Six self-acting feeds are driven from the spindle and can be changed when the machine is running, suitable indices giving the position of the levers for various speeds. An index with stopping is provided for defining the depth of feed, the stop automatically disengaging

the clutch on the feed worm when the desired depth has been drilled. An important feature of this index is that the feed can be read off direct, and no process of addition or subtraction is necessary.

These machines are manufactured by Messrs. Selig Sonnenthal and Company, of London and Coventry.

JUNIOR ENGINEERS.

THE maximum speed of a grindstone is that imposed by the limit of bursting the wheel due to the centrifugal force, and this determines the running speed in most cases; on the other hand, the slower the speed the more easily does the stone wear, and the cutting power is reduced. For emery wheels run wet the speed is that at which the water will stay on the rim, this maximum velocity being 4,000 feet per minute, and in the case of the dry wheel



the speed adopted for general tool work is 5,500 feet per minute, this being well within the test speed to which the stones are subjected. The speeds are given as on the accompanying graph nominally for diameters of from 1 to 10 inches, larger sizes being readily obtained by taking these as tens and reducing the revolutions in proportion. For general work maximum and minimum speeds are fixed from 4,000 to 6,000 feet per minute, with a slight increase in peripheral speed as the diameter increases, this being possibly due to the less weakening effect of the arbor hole as the body of the wheel becomes relatively greater.

In order that the full efficiency may be ensured these speeds must be maintained either by means of stepped pulleys, solid cones, or a device similar to the long drive, or as is done where a large number of machines are installed, transferring the wheels to faster driven spindles as they become reduced in diameter due to wear, and consequently for the same peripheral speed must have higher speeds of rotation. If the wheels are run too fast the surface tends to glaze, owing to the particles being worn smooth instead of rubbed off, and the speeds must be reduced slightly, if the glazing does not yield to a roughing over with pumice stone or the application of a solvent for grease, which may have been deposited, due to the grinding of tools from machines using an oil lubricant.

The wheels employed in grinding machines for finishing surfaces vary in texture and grade according to the work required from them, and for each type of wheel suitable peripheral speeds are recommended by the maker, as also for such special shapes of wheels as are used for sharpening fine tools, cutters, saws, etc., these vary in speed from 3000 to 6000 ft. per minute. For general grinding or hand finishing of small parts, such as brasses, the flat surface is more advantageous than the rim of the wheel, and cylindrical grinders fixed into chucks are so used, the working surface being the end face of the cylinder, this also dispensing with the necessity of altering the speed as the wheel becomes worn; suitable rates for these are shown on the diagram at a constant peripheral speed of 3000 ft. per minute.

Sandstone wheels for tool grinding are run at about 900 ft. per minute, and are subject to the same conditions as emery wheels, the bursting tension of the material being very much lower. The diameter is seldom reduced below 10 inches, but as in the other cases the revolutions for larger sizes can readily be obtained, the speed table for this being on the right of the diagram given. At these speeds water is readily kept on the surface of the wheel, and for tool grinding the stones are used wet; for rough grinding of steel work, however, the dry wheel is preferable, and may have the rim scored across to increase its cutting power.

For polishing buffs, with rings of emery cloth cemented upon the face of steel discs, the speed at the rim is about 10,000 ft. per minute, and varies according to the work required and grade of abrasive material.

Circular saws of carbon steel for cutting cold metal are run at from 40 to 50 peripheral feet per minute, and this may be trebled with high-speed steel teeth. The feed depends on the area being cut, where, as in a bar-cutting machine, several pieces may be simultaneously operated upon. Band saws are run at speeds approximating to 100 ft. per minute for cast iron, 200 for steel and 300 for brass. Plain, soft iron discs are used principally for cutting tubes; these are rotated at a rim speed of 10,000 ft. per minute, sufficiently fast to fuze the disc, and requiring a continuous stream of water to prevent this.

H.M.S. "NEPTUNE."—It has been announced that the *Neptune*, the super-Dreadnought, will be launched on September 30th. This battleship is of 20,250 tons displacement, and is both longer and wider than the *Dreadnought*.

PROGRESS OF THE WHITE STAR LINERS "OLYMPIC" AND "TITANIC."—In the evolution of the modern liner there are well-defined stages of construction besides the five familiar stages of the laying of the keel, framing, plating, launching and completion. These are the terms used to denote the main stages of construction, but in the larger and more complicated structures of the present day there are many intermediate stages that have an interest of their own and afford an indication of the progress of the work. This, of course, is especially the case in such gigantic vessels as the new White Star liners *Olympic* and *Titanic*, now under construction at Belfast, and the report that has already appeared (see our July issue) describing one of those intermediate stages, *viz.*, the construction of the cellular double bottom, has dealt with a number of interesting points regarding the keel, centre plate (or inner vertical keel), floors and other parts forming this portion of the ship, special attention having been directed to the large amount of hydraulic riveting and the appliances for carrying out this work. The double bottom (which in these vessels is more extensive than usual, being carried round the bilge), as is well known, serves several purposes. It provides space for water ballast, which, being so far down in the ship, has an important influence on the stability, which can thereby be regulated as desired under certain conditions. Then, while contributing greatly to the strength of the whole structure, it forms an important element of safety in the event of the vessel grounding at any time, the ship in fact having, as the term implies, a double bottom. The tank top plating is now well advanced, and the next important stage is being proceeded with, *viz.*, the main framing of the vessel. These frames form the ribs of the ship, and a number of the *Olympic's* have already been set up near the after end. It is expected that the stern frame will be placed in position shortly.

A NEW CONSTRUCTION OF VALVE.

ENGINEERS have found by experience that valves for air pumps and other purposes, whether of the hard or flexible character, have to be renewed before being worn out, owing to the central hole becoming enlarged from the vertical motion of the valve on its supporting stud, an example of such action being illustrated in Fig. 1. Such a condition of things renders the valve practically useless, as the enlarged central hole exposes some of the holes in the valve seat, and the vacuum is more or less destroyed. To overcome this difficulty, metal bushes have been inserted in the central hole, but even the vulcanizing of the bush into the valve has failed to maintain a secure fastening, hence, when the bush once becomes loose, the hole quickly wears until the connection is destroyed, and the valve is permanently injured, even after a short period of service, in a manner illustrated in Fig. 2.

Fig 1

Fig 2.

The solution of this problem is one of great importance to engineers, and it is claimed by the Dermatine Co., Ltd., of 95, Neate Street, London, S.E., that the new anchor gun-metal bushes (Hart & Fiegehen's patent) meet all the requirements to overcome the difficulties experienced both in hard and flexible valves.

By reference to Figs. 3 and 4, it will be seen that the bush is incorporated with and vulcanized into the Dermatine valve in conjunction with wire-binding devices so that it cannot work loose, thus preventing the bush from working loose on the one hand, and allowing the valve to bed itself thoroughly on the seat on the other hand. Fig. 3 shows the arrangements for a flexible valve in which the wire arms are hinged to the body of the bush to allow the valve to "saucer." Fig. 4 shows the arrangement of the wire arms as spirals or loops in a hard valve, whereby any risk of cracking from the beat of the valve on the seating or guard is avoided. We think that the firm should easily maintain the claims they make for this new construction of valve.

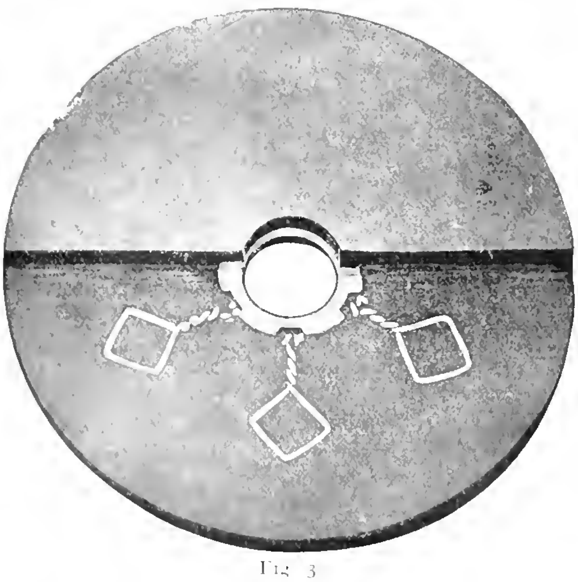


Fig 3

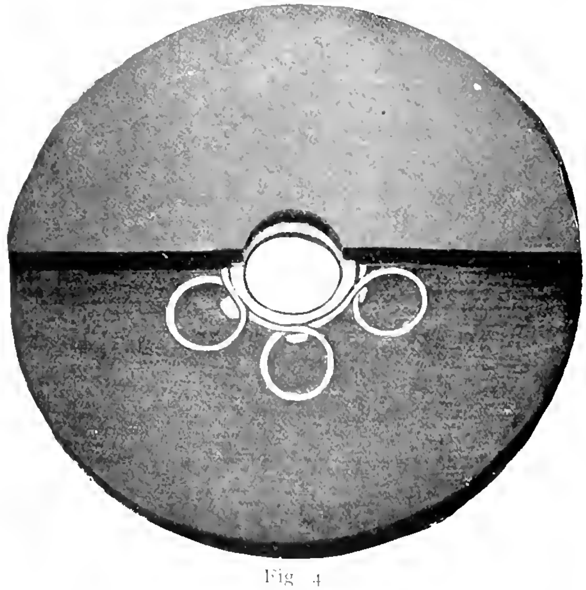
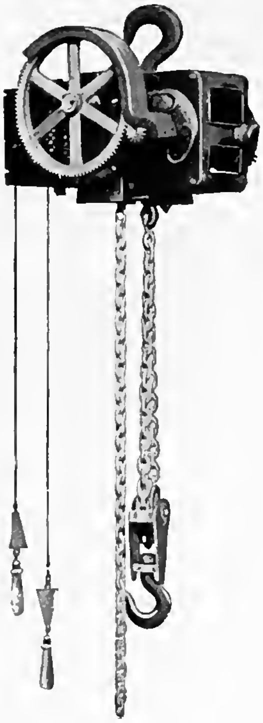


Fig 4

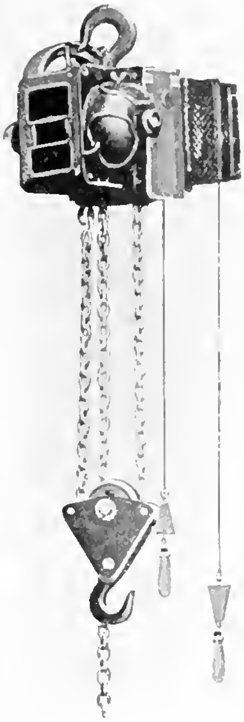
S.S. "PORT MORANT" and "PRINCESS JULIANA."—The s.s. *Port Morant* has been sold by Messrs. Elder, Dempster & Co. for some owners in Buenos Ayres, and the vessel has been renamed *Sarmiento*. Messrs. Matthew Keenan & Co., Ltd., have completed the entire boiler and steam pipe covering for the boat and also for the s.s. *Princess Juliana*, built by the Fairfield Shipbuilding and Engineering Co., Ltd.

AN ELECTRIC PULLEY BLOCK.

We recently had an opportunity of seeing in operation an electric pulley block which has been introduced to the market by The Electric Pulley Block Co., Ltd., who have courteously enabled us to illustrate it herewith. The block has been



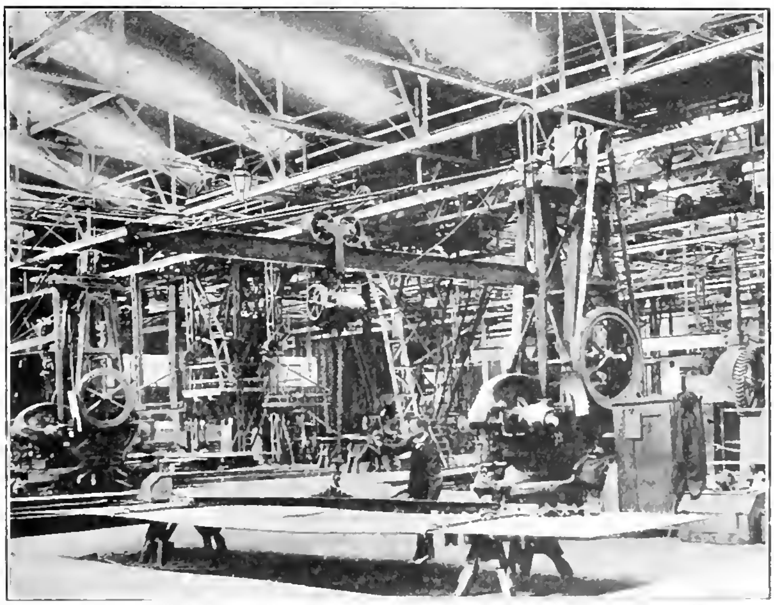
Front View.



Back View

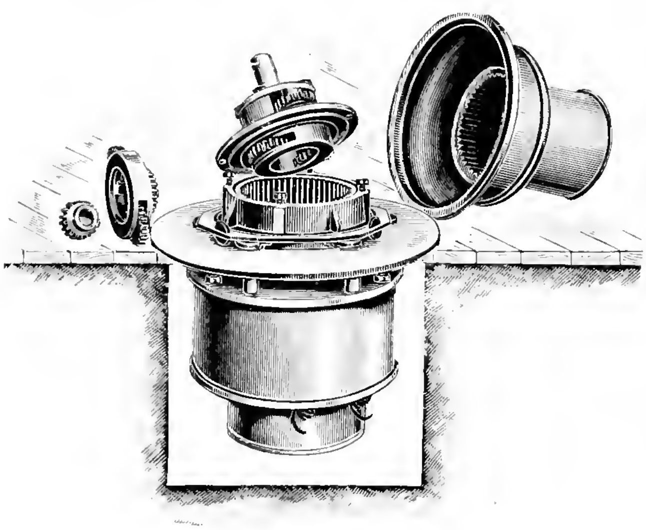
designed for the purpose of lifting weights in spaces and at points where cranes cannot readily be actuated, or where the expense of a crane is not warranted by frequent enough use. The benefit derived from such an appliance was very manifest at the large timber yard where we witnessed it at work. Portable supporting legs were erected at the spot where it was desired to lift and stack loads of timber. A beam of I iron was extended across, on this the electric block rested. The connection to the block was made from the ordinary overhead cable in the yard, the general use of which was for the arc lamps. The manipulation is very simple and handy, easily controlled and guided from quick to slow speed and stop. The fully-loaded speed for the two-ton size is about 8 feet per minute. These blocks appear to be specially suitable for workshops and factories where lifting appliances are frequently required at machines or odd corners, suspended from girders or other overhead work, or where runways are erected for the purpose of transporting weights from one point to another, the lifting, carrying and lowering being done by the blocks fitted to move along the runway by means of rollers. Certain sizes are kept in stock for immediate service, and further information on the subject may be obtained from the sole selling agents, Messrs. A. W. Pocklington & Co., at 47, York Street, Westminster.

Electrical Appliances.—The many services rendered to the community by electrical appliances are so numerous and great that the use of current for labour-saving devices and handiness in manipulation is becoming daily more universal. Lifting gear of various kinds has been devised and found useful in many directions. The portable lamp, which can be lowered into a cavity or small chamber for examination purposes, is itself a very great improvement over the old method of the candle or hand lamp for engine-room service, and when in addition it is fitted with a magnetic stand or seat, so that it may be placed on any convenient spot and held there by its own virtue, or used for picking up any tool or similar object which has been inadvertently dropped into a confined space, the usefulness of the appliance is very greatly enhanced. The electric travelling crane has been found a great convenience in works whether connected up to the workshop set or supplied with current from outside sources. Several docks are also now equipped with electric cranes for cargo work, Middlesbrough for example, and appear



Electric Pulley Block in operation.

to give satisfaction. Steamers fitted on the single-wire system are said to affect the working of the cranes to some slight extent. The electric winch and capstan are also doing service on board ship, as well as on shore. We recently gave an illustration of a very neat capstan which is beginning to come into use for harbour and railway work, warping and



Electrical Appliances, Liddle's Capstan

shunting purposes. The accompanying illustration shows the capstan with the drum removed, exposing the mechanism. The 18 B.H.P. capstan, geared to give a winding speed of 80 ft. per minute, is stated to weigh about 15 cwt., and to be equivalent in pulling power to a 15-ton locomotive shunting engine.

ON HEAT LOSSES.

(IV.)

(*Continued from page 300, Vol. xxxi.*)

THE future development of the marine engine hinges very largely on the reduction of internal heat losses. The matter is well worthy of further investigation and there is every excuse, not only for labouring, but belabouring the subject.

Over fifty years ago, when Professor Rankine was preparing his monumental work on the steam engine, separate steam and exhaust valves were in everyday use. He had every reason to suppose that each generation would bring the engine nearer to his ideal. The Corliss engine was rapidly making its way in public estimation, although it does not appear that Corliss himself recognised the full value of his invention, being apparently under the impression that the resultant economy was due more to the valve gear than to the separate valves. A thinker of Rankine's calibre was not likely to overlook such an important point, and not being addicted to the forming of idle assumptions on any subject whatsoever, we may take it that his theories on steam consumption were based on solid grounds; and what his critics call his *assumption*, that the transfer of heat between the steam and the cylinder walls is negligibly small, has been amply borne out by modern experiments, Professor Callendar having shown that there is only a few degrees range in the cylinder walls.

By way of refuting his dictum anent the non-transference of heat in that way, some present-day philosophers build up assumption on assumption in order to prop up some pet theory. One lays down an elaborate rule, involving many hours' work, and pats himself on the back when he gets within five per cent of the actual quantity. Another, after experimenting with a small engine for a few hours, declares emphatically that there is no condensation. There is only leakage past the valve! This, to us, who are wearied to death trying new kinds of packing, each guaranteed to prevent the leakage of water, which it appears does not exist.

However, they have only an academic interest in the subject and they are not taken too seriously. If they knew a little more about the actual conditions under which marine engines are run, they would soon find out the hollowness of their own assumptions and the soundness of Rankine's reasoning.

The prime factor in most of their formulæ is the surfaces enveloping the steam up to cut-off, and it is one of their assumptions that these surfaces are always in a condition to act as good conductors should act. As a matter of fact, after an engine has been running a short time, the cylinder bottom, both sides of the piston and the cover are all coated with a deposit of such nature as to preclude all possibility of heat transference to the metal it protects, and to which it clings with a tenacity known only to those who on occasion get it on their hands and face.

The disastrous effect of a thin film of grease on a furnace crown is too well known to dwell upon here, and the deposit on the cylinder surfaces offers the same resistance to heat transference there as it does in the case of a furnace crown. Then there is the temperature range to which the cylinder walls are exposed each revolution. It has been demonstrated that the range is infinitesimal, but that does not fit in with their theory and such experiments are looked on with a jaundiced eye.

Consider for a moment the possibility, or rather the impossibility of there being a wide range. The lowest temperature reached by the working steam is that due to the pressure at the moment the valve opens to exhaust, usually about 90 per cent. of the stroke. Taking the engine from which diagrams Fig. 5 were taken: When the valve opens, the piston is about $4\frac{1}{2}$ in. from the end of the stroke, with the temperature at that moment approximately 340°; but with a piston speed of 600 ft. per minute, in $\frac{7}{100}$ths of a second the piston is back again with steam behind it at 371·6°. Bearing in mind that the steam is admitted top and bottom alternately, it is evident that the mean temperature of the cylinder walls lies between the steam lines of the diagrams, and is 358·3° in the example. Particulars are not at hand as to where Professor Callendar placed his thermometer, but probably it was inserted at or near the middle of the stroke. If placed in a corresponding position to the fifth division of the diagram the fluctuation there is exactly what he found, namely, 5°.

Revolutions are supposed to affect the loss in some mysterious way and $\frac{1}{\sqrt{N}}$ is quite a favourite. It was intended for and should be used only in questions relating to single acting engines. The Willans engine takes steam on the down stroke only; on the return, and, in fact, all the time the engine is running the cylinder below the piston is charged with exhaust steam always. Any rule devised to meet such a case can have little value when applied to an ordinary engine.

The slide valve is scarcely ever mentioned. The effect of the cylinder walls is spoken of in some text-books as immense. The power for mischief attributed to them is nothing short of marvellous. The fluctuation in temperature is too slight for the exhaust to benefit from it. What then becomes of all the heat it is credited with absorbing? The only way left for it to escape is through the walls—across the air space between the liner and the cylinder, through the cylinder proper, and then two or three inches of lagging. If their power under these adverse circumstances is immense, what word can be found to describe the effect of the slide valve, and of the comparatively thin plates dividing the live steam from the exhaust steam in the receiver?

In concentric tubes, when the volume and velocity of the cooling fluid is greater than that of the cooled fluid there is scarcely any limit to the condensation per unit area. Similarly, the high-pressure receiver in every marine engine is a condenser in quite a large way. There can be no question as to what becomes of the heat. The exhaust steam carries it off at quite an alarming rate, and every square inch of metal having live steam on one side of it and exhaust steam on the other contributes its quota. There is no film of non-conducting substance here. All surfaces at this stage are scrupulously clean, and with myriads of tiny points that arrest the entering steam and rob it of its heat. The space occupied by the exhaust in the valve chest is greater than that required for steam, and the greater mass at 372° dominates the lesser at 376°. The major part of the piston valve,

whether it admits steam over the ends or inside, is always in contact with the exhaust steam, and the mean temperature of its mass must of necessity be much lower than the live

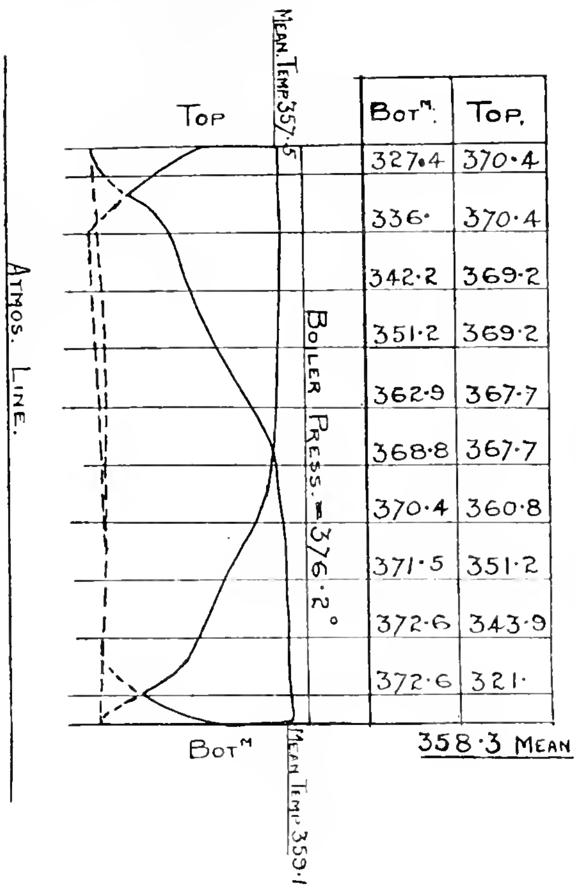


Fig. 5

steam; consequently there is a never ending struggle for the mastery between the temperatures, and, naturally, the live steam gets the worst of it.

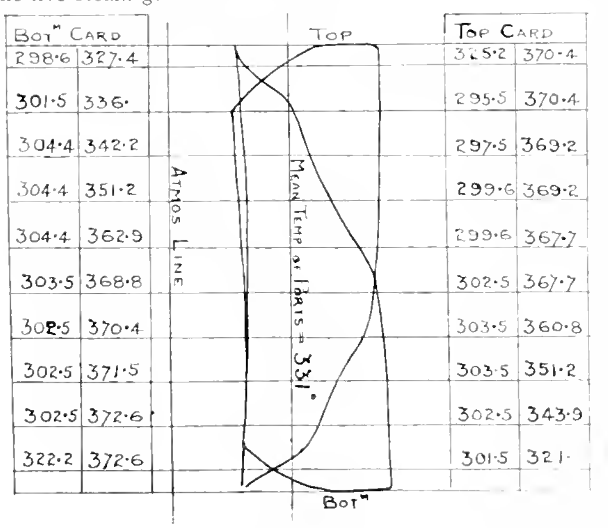


Fig. 6

The main steam pipe is of ample area to supply the engine with steam at full pressure, *if dry*, but when it is constrained to pass what is virtually a condenser, losing thereby anything from 15 to 50 per cent. of its volume, the steam pipe is no longer equal to the demand, and the pressure in the receiver falls accordingly, as a matter of course. In its now semi-fluid state it has to go through the ports, with surfaces even in better condition for abstracting heat from the entering steam, or mixture, than the slide valve and its surroundings.

By taking the temperatures corresponding to the pressures at the usual dividing points, but completely round the diagrams, *vide* Fig. 6, we obtain the mean temperature of the ports. It is 330·9°, so that we have steam entering the receiver at 376·2°, it is reduced to 371·7° at the slide valve, and must now pass through a narrow and crooked port having a mean temperature of 330·9°, or 40·8° below the entering steam. The inevitable result is that the already much-abused working steam has once more to stand and deliver, and by the time cut-off point is reached its temperature is down to 367·3°. Observe, the cylinder walls have neither act nor part in this spoliation.

We can now reckon the damage done up to cut-off point. In the mixture, the proportion of moisture to steam can be ascertained from the densities in saturated steam tables.

Pressure at cut-off is 153·5 lbs. and corresponding density is ·3754. Boiler pressure 173 lbs. and density ·4161, then

$$\text{Dryness fraction} = \cdot 3754 \div \cdot 4161 = \cdot 90.$$

and to find the heat units lost up to cut-off, with dry steam from the boiler, we have

$$(376 \cdot 2 - 367 \cdot 3) + 848 \cdot 5 - (\cdot 9 \times 855) = 87 \cdot 9 \text{ B.T.U.}$$

and this before the engine has made a quarter of a revolution.

The total heat units due per pound of steam by the engine from which these diagrams were taken, between steam pipe temperature 376·2° and hot well temperature, with 18 in. vacuum, 167·9°, is 250, and of this 87·9, or 35 per cent., is lost before a stroke of work is done. Think of it! Is it any wonder that stationary engine designers poke the finger of scorn at us? With receiver losses only partly wiped out they can turn out compound engines with 115 lbs. pressure that use less coal per horse power than our best quadruples at 215 lbs. It is enough to make Professor Rankine turn in his last resting place.

Fortunately the 87·9 B.T.U. are not all lost, because a percentage of the water in the mixture is re-evaporated during expansion, and at the slide valves, and does work at a lower temperature. Referring to Fig. 2, page 206, vol. 31, it will be seen that the dryness fraction rises about $3\frac{1}{2}$ per cent. between cut-off and exhaust in H.P. cylinder. A small portion is lost on the surface of the M.P. valve, but is over-balanced by re-evaporation in M.P. cylinder, the dryness fraction there rising about 6 per cent. The L.P. valve contributes its quota to the loss account, sufficient to reduce the fraction nearly 20 per cent. at L.P. cut-off, but as it rises over 22 per cent. before opening to exhaust, the gain about balances the loss in that cylinder.

The result of all this interchanging of heat is to reduce the total loss from 35 per cent. to about 29 per cent., and this with a triple-expansion engine of the best modern type.

Although a handful of heat units is saved, the melancholy fact remains that 35 per cent. of the total amount is offered up to the gods of prejudice and conservatism, on the part of marine engine designers.

Meanwhile, and until they see the error of their ways, we have to make the best of what they give us. Economical running is only of subsidiary interest to them. We who run the engines can only growl at the wilful waste we cannot prevent. The owner also growls, and with reason, at the coal bill, and time will show how much longer he agrees to accept as up-to-date a machine that is really and truly fifty years behind the times.

As regards the coal, it is a great advantage to have a simple method for calculating the consumption from the indicator diagram. In time of stress, when the bunkers are peopled with the imps and demons of unrest, with coal fever in the wind, it is extremely useful to have a check that can be used with confidence. At such times the engineer is not in a fit condition to worry through quadratic equations.

Rule I., given at page 300, vol. 31, has been found to agree exactly with measured tests, and was given in such fashion as to direct attention to the losses at the slide valves.

Another method for calculating total steam consumption from the H.P. diagram alone, is now offered in the hope that engineers will test its accuracy.

As the total amount of steam or mixture used by the engine

must pass through the receiver, we ought to be able to find it, some way or other from the H.P. diagram.

We find from Fig. 5 that with dry steam supplied from the boiler at 376·2°, as the result of contact with comparatively cold surfaces, the temperature is reduced to 371·7° when the valve is opening the port. The mean temperature of the ports, *vide* Fig. 6, is 330·9°, with the result that steam entering it at 371·7° is reduced to 367·3° at cut-off. It is manifest that a considerable portion of the entering steam has been condensed during admission, but although the temperature of the *steam* is known, the temperature of the water present is not known. However, we have two known temperatures to guide us, *i.e.*, at cut-off, and the cylinder walls, 367·3° and 358·3° respectively; it is clear that the latter is also the temperature of the working steam. The mean of these temperatures, 362·8°, is the steam only, the temperature of the water in it has yet to be found, and as its influence is detrimental the tendency is downward, and the required temperature must of necessity lie between the mean just found and the temperature of the working steam. For example: Temperature of steam entering cylinder $\frac{367·3°+358·3°}{2}=362·8°$, then, $362·8°-358·3°=4·5°$ = fluctuation of temperature in cylinder walls, and $\frac{362·8°+358·3°}{2}=360·5°$ = temperature of the mixture of steam and water. From the steam tables we find the density of steam at 360·5° to be ·3469. The temperature of the steam entering the receiver is 376·3°, and its density ·4161, then the dryness fraction at cut-off $= ·3469 \div ·4161 = ·83$.

The indicated steam is 12·0 lbs. per I.H.P. per hour, then, the actual steam in lbs. per I.H.P. per hour $= 12 \times \frac{·4161}{·3469} = 14·28$ lbs.

By the rule given, page 300, it is 14·21 lbs. per I.H.P. per hour.

The above refers to a triple-expansion engine, cutting-off at ·52. We will now apply it to a compound at 72 lbs. pressure, cutting-off at ·35. 72 lbs. = 317·5° and density ·2013.

Temperature of steam entering cylinder $=\frac{309·4°+295·7°}{2} = 302·6°$, and $302·6°-295·7°=6·9°$ = fluctuation in cylinder walls; and $\frac{302·6°+295·7°}{2}=299·1°$ = temperature of the mixture of steam and water. The density at $299·1° = ·1563$ and the dryness fraction at cut-off is $·1563 \div ·2013 = ·77$.

The indicated steam consumption is 14·0 lbs. per I.H.P. per hour, and $14 \times \frac{·2013}{·1563} = 17·92$.

The amount by rule 1, = 17·61.

Temperatures have been used throughout, because the matter is purely a heat question, but it can be done with pressures in the same way, care being taken in either case to measure pressures at all points from the atmospheric line.

COMMERCIAL REPRESENTATION IN BUENOS AYRES.—Mr. Frank Stuart Milne, who some time ago left the Newcastle-upon-Tyne Electric Supply Co., Ltd., to take up an important appointment in the Argentine in connection with the electrical department of the State railways, has, in view of the rapid commercial expansion of the Republic, commenced business in Buenos Ayres as commercial engineer and agent for British railway, mechanical and electrical engineering firms. Associated with him as British engineer and secretary is Mr. J. A. Seager, A.M.I.C.E., A.I.E.E., and any firm desiring representation should communicate with the latter gentleman at his office, Emerson Chambers, Newcastle-on-Tyne.

THORN'S SCHOOL OF MARINE ENGINEERING.—At the examination for extra first-class engineers held in July, the following candidates were successful:—Mr. A. Ewing, Mr. J. Potts, Mr. E. Vie, Mr. C. S. MacLean and Mr. P. J. Brown. They were all prepared by Messrs. Thorn's system of postal tuition, and four passed the first time up, thus testifying to the highly satisfactory nature of this method of coaching, and making 188 successes for "extra first" from the establishment of W. H. Thorn & Son, 5, Waterville Terrace, North Shields.

OBITUARY.

Robert Band Pope.—We have to record with regret the death, at his residence in Dumbarton, on July 29th, of Mr. Robert Band Pope, partner in the firm of Messrs. Denny and Co., engineers and boilermakers, Dumbarton. Deceased, who was 74 years of age, had been connected with Messrs. Denny & Co., for considerably over half a century. A skilful engineer, who combined the facilties of insight and application, he was so successful in the fulfilment of the parts of works manager and chief draughtsman from 1857 to 1885 that in the latter year he was admitted a partner of the firm, and his

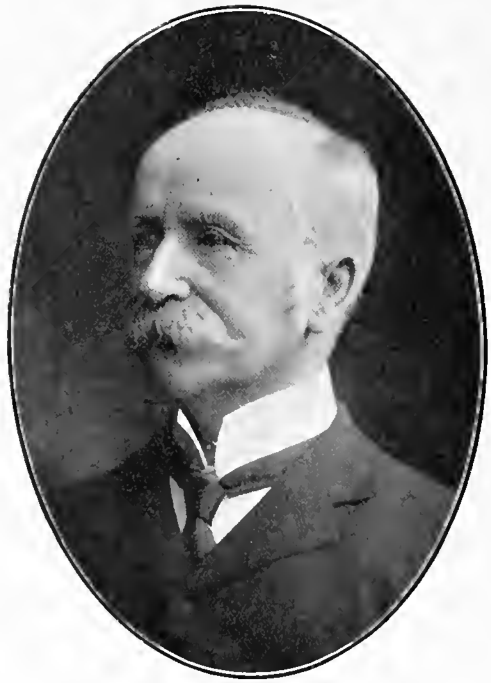


Photo by Lafayette.

The late Mr. R. B Pope.

name is associated with its numerous successes. His skill was reflected in the results obtained from the first of the British India Company's steamers. When the compound engine was introduced he designed those of the *Batavia*, the first compound engines supplied to the Cunard Company, and various others. Associated with his better known partners, the late Mr. Walter Brock and Mr. James Denny, the deceased Mr. Pope shared in the credit of the successes attained by the firm in connection with quadruple-expansion engines and, more recently, with turbine engines on the Parsons' principle.

REVIEWS.

The Gas, Petrol and Oil Engine. By Dugald Clerk, F.R.S., M.Inst.C.E., etc., etc. Longmans, Green & Co., London, New York, Bombay and Calcutta. 12/6 nett.

THIS book was originally published in 1886, under the title of "The Gas Engine," while the next edition came out in 1896, with considerable additions under the title of "The Gas and Oil Engine." Such great strides have been made in the science and practice of this class of engine in general, and such marked development has been effected in the petrol and oil engine in particular that the title and contents of the present edition have been extended, and the book, as a whole, has been practically rewritten. The science and practice have been treated separately, the book being divided into two volumes, the one under review being entitled

"Thermodynamics of the Gas, Petrol and Oil Engine," while the other will be "The Gas, Petrol and Oil Engine in practice." The volume under review commences with a comprehensive historical record dating from the year 1680 A.D. up to 1908 A.D. Much of the matter is culled from the records of the monumental research work carried out by the author in this particular branch of science and described by him in the transactions of many of our scientific societies. The book will stand to-day as its previous editions have done, as the up-to-date standard text book on this particular subject. Some valuable appendices have been added to make clear many of the properties of gaseous explosions and the valuable report of the British Association Committee on gaseous explosions has been included in full. It is recognised that this report represents the latest information available on all the properties of gaseous explosions. The work of American and Continental investigators has been fully noticed, and this part of the book is distinctly valuable as representing research work of the greatest possible value. The author's treatment of his subject on a systematized basis will materially assist the student to grasp the essential factors in each problem, and in no direction will systematized research be of more value than in the adoption of internal combustion engines of large power for marine purposes.

Modern Navigation. By W. Hall, R.N. (7/6). University Tutorial Press, Cambridge.

WE have a copy of the second edition of this book before us and find that the first edition, edited in 1904, was merely an attempt to summarize the methods then current in teaching and practising navigation. Since that date various writers on the subject have made the practical side more scientific, whilst the mathematical part has been made more practicable. The new Inman's tables, generally used, made it necessary to rework all the models by the newer and shorter methods. This work serves to elucidate a system of teaching which should be essentially practical whilst insisting on a clear understanding of the mathematical theory. To prevent misconception, it may be stated that this is a text book written for a definite purpose, with a very limited scope, namely, instruction as far as and including the problem of fixing position by one position line, derived from sights of the sun, and another, derived from a bearing of the land. We think that within these limits the treatment both of the preliminary theory and the eventual practical outcome of the theory is very exhaustive and well adapted to the requirements of cadets who are working up this subject. We find the first portion of this book is devoted to definitions, and finally to solid and spherical geometry in which the cadet, as he is carried on to understand the principles of spherical trigonometry, is very clearly instructed by definitions, and the limits of a triangle to such dimensions as will lie on a hemisphere, and so form a natural triangle, in which two sides are greater than the third side and each angle with each side must be less than 180 degs., whilst the three sides taken together must be less than 300 degs., the three angles must, together, be greater than 180 degs., and less than 540 degs. The use of a polar triangle is very well explained as regards its formulæ for making up the formulæ of the simple triangle. The use of the natural Haversine formula and the logarithmic Haversine formula are well explained and their application to the solution of triangles is well set out. Spherical areas both as regards the line and triangles are well explained with examples following. We then come to a distinctively written chapter upon navigational machines, which are both illustrated and clearly described and then finally a plane chart with plane sailing is introduced, and the plane chart is commented on as not quite agreeing with a spherical chart. In great circle sailing it is pointed out that the shortest track between two places is the arc of the great circle which passes through them. Tactical problems, involving the instructions to a vessel of a given speed either to rejoin the flag, to change its station, or to approach direct to a given range, are well set out with diagrams and careful explanation, so that cadets can follow these examples of tactics. Then the chart work is carefully given with the fixing of a point as to which unknown deviations, which might introduce errors in the fix, are taken note of, and finally a long chapter is given to nautical astronomy, in which is clearly marked out all that navigational cadets require to know. The book closes with extracts from the Nautical Almanac and with a series of additional examples, whilst at the end of these examples is a column of results from page 60 to page 231, so that the students can ascertain how far the working out of the examples given is correct.

BOOKS RECEIVED.

The Principles of Fitting. By Joseph G. Horner, A.M.I.M.E. 4th edition, revised and enlarged. Price 5/- net. London: Whittaker & Co., 2, White Hart Street, E.C.

Shipping. A guide to the routine in connection with the shipment of goods and the clearance of vessels inwards and outwards, with numerous reproductions of actual shipping forms. By Arnold Hall and Frank Heywood. Price 1/- net. London: Sir Isaac Pitman & Sons, Ltd., 1, Amen Corner, E.C.

The Engineering of Ordnance. The Gustave Canet Lecture, delivered before the Junior Institution of Engineers. By A. Trevor Dawson M.I.C.E., M.I.M.E., etc. Price 2/6. London: Percival Marshall & Co., Poppins Court, Fleet Street, E.C.

CORRESPONDENCE.

We do not hold ourselves responsible for the opinions expressed by our correspondents.

Re Ship's Fire-Extinguishing Apparatus.

To the Editor of the MARINE ENGINEER AND NAVAL ARCHITECT.

Dear Sir,—In your issues of June and July reference is made to dealing with cargo fires by means of inert gases, and your correspondent emphasizes the fact that the reduction of the ratio of oxygen to other gases present is the most important point to be kept in view.

I think another and equally important point is the prevention of re-ignition of cargo after a fire has been extinguished, and the temperature reduced to normal. This appears to require most careful attention, and experiments with fires generated by burning paraffin—impregnated material are not in my opinion sufficiently far reaching to give any real estimate of the actual fire-extinguishing properties of inert gases as applied to large bulk cargoes such as cotton, jute, wool, etc.—Yours faithfully,

GEORGE CANNING.

Institute of Marine Engineers.—The second Lloyd's Register Scholarship in Marine Engineering, founded under the auspices of the Institute of Marine Engineers, and for which examinations were held in July last at Glasgow and Newcastle-on-Tyne, has been won by Mr. Frank Duncanson, of 15, Harold Street, Sunderland. The scholarship is of the value of £50 per annum tenable for two years, and is open for competition to graduates and associates of the Institute. Mr. Duncanson is the son of the late Mr. F. Duncanson, Board of Trade surveyor, and is at present serving his apprenticeship with Messrs. George Clark, Ltd., Southwick Engine Works, Sunderland. He will attend Sunderland Municipal Technical College. The winner of the first scholarship was Mr. James R. Thomson, of Clydebank, apprentice with Messrs. Wm. Beardmore & Co., Ltd., of Dalmuir, who is now pursuing his studies at Glasgow University. Under the awards schemes of the Institute, prizes for papers submitted by members of the various grades of membership have been awarded as follows:—*Associate Members*, Stephen Award to the value of £2 for paper on "The Turbine," won by Mr. Jas. S. Candee. *Associates*, Stephen Award, value £2, for paper on "Feed Heating," with descriptions of types, won by Mr. W. W. Adamson. *Graduates*, Ritchie Award, value £2, for paper on "Functions of the Air and Circulating Pumps," with descriptions of types, won by Mr. Walter Smith. Particulars in connection with the above examinations and competitions, with the necessary qualifications for the various grades of membership may be obtained on application to Mr. Jas. Adamson, Hon. Secretary, Institute of Marine Engineers, 58, Romford Road, Stratford, London, E.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

HAPPILY for the industrial welfare, not only of the Clyde and Scotland, but of this country as a whole, a settlement was arrived at between the Scotch coal-masters and the miners' representatives, on the last day of July, which it is anticipated will ensure a long period of freedom from an experience similar to that recently gone through. With the removal of this incubus, the industrial outlook has been materially improved, and the way paved for the recovery in trade which had begun to manifest itself previous to the appearance of serious trouble in the coal trade, first in England, and then in Scotland. Something like a general start was made on August 2nd, at most engineering, shipbuilding and other establishments, under much more congenial conditions than, for a long time, appeared possible.

New Contracts.—Fresh work for shipbuilders and engineers since last month's notes were penned has been almost inconsiderable, and there is little immediate prospect of betterment, although one or two good contracts are under negotiation, and apparently progressing to fruition. Messrs. Barclay, Curle & Co., Whiteinch, are to build a steamer of about 3,700 tons gross, for the Booth Line, Liverpool. Messrs. William Beardmore & Co., Dalmuir, have been commissioned to build an additional sludge-carrying steamer for the Sewage Committee of the Glasgow Corporation. Messrs. Bow, McLachlan & Co., Paisley, are to build a steam mooring lighter for the British Admiralty; Messrs. William Hamilton and Co., Port Glasgow, a steamer on the Isherwood longitudinal system for Liverpool owners; the Greenock and Grangemouth Dockyard Co., two steamers of 2,000 tons deadweight for Messrs. James Currie & Co., Leith; Messrs. A. Rodger and Co., Port Glasgow, a vessel of 300 ft. in length and 5,000 tons deadweight for Swansea owners; the Caledon Shipbuilding Co., Dundee, a ferry steamer for the Dundee Harbour Trustees.

Work at Port Glasgow and Greenock.—With the exception of the order above noted as having been booked by Messrs. A. Rodger & Co., Port Glasgow (the order secured by Messrs. Wm. Hamilton & Co. having been booked in July subsequent to the penning of our notes), nothing in the way of new work has been secured by builders in the lower reaches since August set in. Possibly the holiday period—which in the case of Port Glasgow and Greenock occurs a fortnight later than the Glasgow Fair period—may to some extent account for the dearth of new bookings. Work was fully resumed in all the yards from the 10th to the 12th August. On the 18th, the Clyde Shipbuilding and Engineering Co., sent off the stocks a finely modelled screw steamer of good speed for the passenger and cargo service carried on between Sydney and Hong Kong by Messrs. Burns, Philp & Co. On the vacated berth the keel is about to be laid of a new steamer for Messrs. James Currie & Co., Leith. The other two berths in the yard are also occupied with steamers in the later stages of construction. In the company's engineering and boiler making department briskness prevails, and the hauling-up slip is being well requisitioned for repair work. The yard and engine works of Messrs. Ferguson Bros. are only moderately occupied at present, the largest item of work being a powerful dredger to the order of the London and North-Western Railway Co., which is nearing the launching stage. Messrs. Wm. Hamilton & Co., with the order above noted from Liverpool owners, have five vessels on the stocks, all being constructed on the Isherwood longitudinal system. Messrs. Russell & Co., who contrive to keep all their thirteen berths occupied, launched, on August 16th, the screw steamer *Ardgryffe*, of 8,300 tons capacity, for Greenock owners, the machinery for which has been made by Messrs. Rankin and Blackmore, Greenock. The other Port Glasgow yards, Messrs. A. Rodger & Co.; Robert Duncan & Co.; Murdoch and Murray, and D. J. Dunlop & Co., are all poorly off for work, in most cases only one vessel being on hand.

At Greenock, while the large yard of Messrs. Caird & Co. still remains lamentably barren of work—not a single vessel being on the stocks—measures are being taken to better equip it for important orders which may soon be received. In the dockyard of the Scott Shipbuilding and Engineering Company work is now being vigorously pushed forward on the construction of the *Colossus* of the new "Dreadnought" class. On July 19th, in presence of a numerous party, Mrs. Charles C. Scott, wife of the principal partner of the firm drove the first rivet in the keel plate of the vessel. Close on 1500 men are now employed in the Scott establishment, 400 or 500 of whom are engaged in the Company's East Yard. Amongst other work on hand is a steamer of 7,700 tons for the Clyde Shipping Co.

"The Mile"—Skelmorlie or Maplin.—Although preference has been expressed by the Admiralty for the Skelmorlie Mile as a standard arena for speed trials of torpedo destroyers, the conditions imposed on builders of such craft in the South of England are to some extent being modified, through representations made by the contractors. The obligation to send their vessels so far away, it is said, was causing Southern firms a prohibitively high figure. It is believed, indeed, that the expenses of sending a boat from the Solent to the Clyde, and maintaining her during her speed trials, has, in some cases, run into four figures. It is now generally conceded that the Maplin Sands as an arena for speed trials of such craft yields much better results, the advantage amounting in some cases to almost a knot and a half. In the case of the *Cossack* experiments with her on both arenas showed that there is a good knot of difference between the Maplins and Skelmorlie. This being so it is only natural for Southern builders to prefer the Maplins, especially so if the cost of sending to the Clyde is as represented. In the case of the destroyer *Crusader*, built by Messrs. White, of Cowes, which has just run her official steam trials in the estuary of the Thames, the Admiralty are believed to have said, in effect, to the contractors, that they could take the vessel to the Clyde and get thirty-three knots under the severe conditions of the contract, or they could stay by the Thames and get thirty-four knots under correspondingly severe conditions. On preliminary trial on the Thames, the *Crusader*, some little time ago, attained a speed of 34.78 knots, but for the reason above indicated this result is not quite so good as it looks.

Speed Trials of Destroyer "Swift."—This notable 36-knot production of Messrs. Cammell, Laird & Co., Birkenhead, is still on the Clyde undergoing trials with the view of obtaining the greatest speed possible, and of affording experience with various forms of propellers. Previously fitted with three-bladed propellers, she was again docked at Greenock on the 16th August, and fitted with propellers having four blades. Two days later she entered upon a series of runs on the measured mile at Skelmorlie and in the Firth of Clyde. It is rumoured that the vessel will shortly be taken to Birkenhead for some modifications to the hull.

Armour Plate Orders.—The contracts for the armour plate of the four battleships of the "Dreadnought" class, authorised in this year's naval programme, have been about equally divided between the following five firms:—Messrs. Wm. Beardmore & Co., Parkhead Forge, Glasgow; Messrs. John Brown & Co., Sheffield; Messrs. Vickers, Sons & Maxim, Barrow-in-Furness; Messrs. Armstrong, Whitworth & Co., Newcastle-on-Tyne, and Messrs. Cammell, Laird & Co., Birkenhead. Messrs. Beardmore's share of the contract, which is intended for the *Colossus* now building by the Scotts' Shipbuilding and Engineering Co., Greenock, consists of 1650 tons of armour plate. The armament, it is reported, will show a great improvement on that of the earlier "Dreadnoughts," the steel being of special thickness and strength over the more important parts of the hull.

Dock and Shipyard Cranes.—Messrs. Applebys, Ltd., at both their Glasgow works at Parkhead, and at Leicester, are executing important orders for cranes for docks and shipyards. In addition to the 100-ton electric Giant crane which they have supplied to Messrs. Earle's Shipbuilding and Engineering works, the Company are erecting a similar 100-ton crane at the works of Messrs. Geo. Clark Ltd., Sunderland, and have just shipped to Japan a cantilever crane of 150-tons power. They have recently completed a 75-ton floating crane, and have in hand at present 40, 30, 25 and 20-ton electric overhead travellers, a 25-ton portable electric crane for the Bristol Docks, besides numerous jib-cranes and overhead travellers of less power. At the Glasgow works,

several large Temperley transporters are also under construction.

Torpedo Factory at Greenock.—Substantial progress is being made with the construction of the Government torpedo factory at Battery Park, in the west end of Greenock, and with frontage to the Firth of Clyde. The steel structural work of the main factory, which has been prepared by the Motherwell Bridge Building Co., has been fully erected, and the masonry walls of very substantial construction are nearing completion. The contractors are Messrs. Robert Neill & Sons, Newcastle and Manchester. The main factory consists of a series of open bays with cross roofing on the saw-back principle to take the fullest advantage of daylight. Provision is made in each bay for overhead runways traversing the full length of bay. The testing house is a masonry building adjacent to the main factory and of very substantial construction. Altogether the factory is rapidly taking shape, and although the equipment of the sheds will absorb a large portion of the available time the works are likely to be in going order when the special workers arrive from Woolwich in the spring of next year. Electricity will solely be used for lighting and power purposes, the current being supplied from the Generating Works of the Greenock Corporation.

New Graving-Dock Projects.—To the west of the new torpedo factory above referred to is a tract of ground, to which easy access is obtained from the Firth, which, according to a revived rumour, the Admiralty are seeking to acquire for the construction of a new naval graving dock. The present unoccupied area extends to about forty acres, and the site offers not a few advantages for such a purpose. The rumour, however, lacks any serious confirmation. Greenock Harbour Trustees continue to interest themselves—through a committee specially appointed for the purpose—in the question of a graving dock within the jurisdiction of the Port to be constructed, or subsidized, by the Government and the foregoing rumour has necessarily given a fillip to the public interest in the question. The Clyde Trustees also, through the special committee appointed for the purpose, are furthering the project of a new graving dock for the Port, which would be available for naval ships, and which the Admiralty are being invited to assist in constructing. Nothing new in this connection has transpired since the note on the subject in last month's issue was written, but it is expected that the *Enchantress*, with the Lords of the Admiralty on board, will before long pay an official visit to the Clyde. One or two of the establishments where at present naval work is proceeding will likely be visited, but the chief object, it is believed, is to go into the question of dry dock accommodation with the Clyde Trust and any other authority which has a definite scheme to submit for consideration.

New Dry Dock for Burntisland.—The Burntisland Harbour Commissioners and the North British Railway Company have entered into an arrangement with the Hudson's Consolidated Co., London, to lease to the latter sufficient ground on a suitable site for constructing a dry dock and repair works and operations are to be actually begun shortly. The dock contemplated is to be about 660 ft. long, 65 ft. wide at entrance, and 24 ft. deep over the sill. It is to be divided into two parts so that either one large vessel or two small, aggregating about 8,000 tons, can be conveniently accommodated. The pumping machinery to be provided will be capable of emptying the dock at the rate of fully 600,000 cubic feet of water per hour, and the dock will be equipped with 60-ton sheer legs, electric cranes, etc. Shops and plant of the most modern description will be laid down for repairs to vessels and machinery.

THE TYNE.

(From our Own Correspondent.)

The Position of the Shipbuilding Trade.—The somewhat rapid placing of orders for new tonnage, which was a noticeable feature a few weeks ago, gave rise to hopes in many quarters that the time of trade revival had really come at last. There *has been* a revival of a kind, but it is now seen that it was not founded on the real exigencies of the market, but rather on the desire of shipowners to take advantage of a "slump" in prices to supply themselves with vessels which might turn out to be good investments at a later date. It is to be feared that the real trade revival is yet to come—that is to say, a revival to be brought about by such a scarcity of tonnage as is not yet shown. Such a time must necessarily come, notwithstanding the discouraging circumstances that many well-equipped steamers are still laid up at the various ports. The natural wastage of service will eventually bring about the scarcity, if too much speculative building is not indulged in, and it is to be hoped that whenever a demand for tonnage, stimulated by scarcity, arises, our English builders will, as hitherto, be able to beat all competitors in catering for customers' requirements.

Armstrong, Whitworth & Co.—The Elswick yard of this great Company is still kept fairly busy and the number of hands engaged is now little, if any, below the average, a large proportion of them being required to complete the fitting of the Brazilian battleship, which is still in hand. At the Company's Low Walker yard some berths are without occupants, but it is expected that keels will be laid in them before the winter sets in. The new jetties and building berths that are being prepared in the near vicinity are being energetically proceeded with, and work is being provided for hundreds of men.

At the Bill Quay yard there is a fair amount of work going on, Messrs. Wood, Skinner & Co. having been successful in booking orders early in the year, when orders for tonnage were most difficult to get. Messrs. Dobson & Co. have put down a keel lately, and it is expected that another berth will be occupied shortly. It is stated that the firm have just booked orders for three vessels. Messrs. Swan, Hunter and Wigham Richardson's yards at Walker and Wallsend, though having on the stocks several vessels of a special class, are far from being engaged to their full capacity. The prospective laying down of a large pontoon dock for the Government has given a tone of cheerfulness to the outlook, and some confidence is felt in the neighbourhood that a fairly busy time in the winter months may be looked for.

State of Work at Jarrow.—If the people who are so much opposed to the maintenance by the country of a preponderating Navy could find themselves in a position to note the change that has been brought about in Jarrow by the placing with the Palmer's Company of an order to build a battleship, they might abate somewhat of their opposition, and might be disposed to allow that even the augmentation of our fleet is not an unmixed evil. The aspect of gloom, which was very much in evidence at this centre a short time ago, has given place to cheerfulness, and it is absolutely certain that both working people and business people in Jarrow have been immensely benefited by the placing of this order. The Jarrow yard has room for more work of this description, and as the productive facilities of the establishment are of an extremely high order, it is hoped that in due course there will be more of it forthcoming. The Company have been invited to tender for the construction of a steamer for the Cunard line.

The Repairing Yards.—The repairing yards at Hebburn and Wallsend, though not fully occupied, are being kept fairly busy, and at each centre important contracts are being negotiated, and will, when secured, provide work for a large number of men in addition to those now employed. At the Commercial Dry Docks there are a couple of vessels under repair, and several of the graving docks at South Shields are occupied with vessels undergoing survey or re-classing. The Smiths' Dock Company have as usual, most of their docks and pontoons occupied with vessels being repaired or painted, and at Messrs. Readhead's repairing department business is satisfactory. Messrs. Eltringham of the Stone Yard Quay, South Shields, have a small vessel on the stocks, and another in an early stage of construction. The firm have also some repair work in hand.

The Engine Works.—At the Marine Engine Works there is little change to note, but the erection of a mammoth crane at one of the leading establishments is an event that augurs well for the future. The hoisting power already available in the case referred to was quite capable of dealing with extraordinary material, and the view is expressed in many quarters that there must be some very heavy work in prospect, or this exceptional lifting power would not be considered necessary. The steel boat department at Messrs. Clark Chapman & Co.'s works is kept busy, there being a good demand for that kind of steamship accessory. Messrs. Parsons' works at Walker

Gate and Wallsend are still well employed, but makers of steamship auxiliary machinery at those centres are not particularly busy. Ironfounders do not show improvement, and brass foundries and copper smithing shops are generally short of work. Timber imports at Tyne Dock have increased, and at this centre a lively tone is apparent.

The new battleship *Minas Geraes* has been removed from the Elswick yard to the new equipment yard which Messrs. Armstrong, Whitworth & Co. have established at Walker. It is understood that two repair contracts of importance have been secured by the Elswick Company, and it is also stated that as a result of the Imperial Defence Conference, now being held between representatives of the Australian Commonwealth and the Admiralty, a considerable amount of work will eventually be placed with British shipbuilding firms.

THE WEAR.

(From our Own Correspondent.)

Shipbuilding Orders.—It has just been announced that Messrs. Doxford have booked a number of new orders, and that Messrs. Bartram & Sons have been commissioned to build a large steamer for an important local firm of shipowners. Messrs. J. L. Thompson & Sons are now preparing a fifth berth for the reception of a keel, and when this is placed the whole available building space of this large yard will be utilized. This condition of matters portends a busy winter at this establishment. Messrs. Robert Thompson and Sons have a vessel in an advanced stage on the stocks and two others in early stages. Ship repairing at the firm's Bridge Dockyard continues to be fairly active. Messrs. Short Bros. have four vessels in hand, and at Messrs. Osborne and Graham's three berths are occupied. It is rumoured that a couple of orders that were placed locally some weeks ago have been cancelled.

Messrs. S. P. Austin & Sons have had the steamship *Blagdon* in their graving dock for some time undergoing an extensive overhaul, and the pontoon dock has been kept pretty constantly occupied. The s.s. *Creole Prince* has been docked for the carrying out of somewhat important repairs. The firm have also new work in hand, and are on the whole fairly busy. Messrs. John Crown & Sons are busy both in the new work and repair lines, but at Messrs. Blumer's yard there is at present little doing. It is satisfactory that many foreign shipowning companies still find it to their advantage to get their requirements in new tonnage supplied by English builders, and it is doubtless owing to this well-defined preference that some Wearside firms have been able to keep their machinery running during the whole time of the existing depression. The Sunderland Shipbuilding Company is among the firms that have from time to time been successful in securing foreign orders, and we are pleased to hear that at the moment they have a considerable amount of work for foreign owners in hand.

The Engine Works.—The Palmer's Hill Works, though not in what might be called "full swing," are kept fairly active in the principal departments and it is satisfactory to note that the demand for Dickinson's patent crank shaft continues to be well maintained. The ironfounding department at the North-Eastern Marine Company's works is becoming distinctly busier, and the staff of skilled operatives has been augmented. At another important local foundry there is also a large accession of work, and it has been found necessary to increase the working staff. Local forges are busier, and electrical works continue to be kept fairly well employed. It is stated that large consignments of steel plates for shipbuilding have recently been received in Sunderland.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough. Trade at this port is somewhat brighter. Messrs. Raylton Dixon & Co., Cleveland Dockyard, are reported to have secured the contract to build two medium-sized cargo boats, as showing the advantage of their system of building. The s.s. *Victor Hugo*, recently launched, is built on the patent cantilever framed system with top side water ballast. She is 301 ft. long, 43 ft. beam, 21 ft. 4 in. moulded depth, carrying 3700 tons deadweight on 18 ft. 4½ in. draught. Her net register tonnage is only 1230 tons, thus she carries over three times her net R.T. Her water ballast is 1165 tons, of which 485 tons is carried in her top side tanks under the deck, she is engined by Messrs. Richardsons, Westgarth and Co., Middlesbrough, being built to Lloyd's and French Law requirements.

In consequence of the improvement in trade Messrs. Richardsons, Westgarth & Co. have reopened their foundry, and are reported to have secured the contract for a cargo and passenger steamer to be built by Messrs. The Goole Shipbuilding and Repairing Co., for Messrs. Borneo Co., Ltd., London, for their Sarawak coast service. She will carry about 230 tons deadweight on a light draught, her general dimensions being 158 ft. by 25 ft. by 9 ft. moulded depth, built under the superintendence of Messrs. Flannery, Baggalay and Johnson. Compound engines of about 18 in. by 36 in. by 24 in. stroke. A start has been made with the erection of the Ormesby Rolling Mills on land on the south side of the Cargo Fleet Ironworks. The site is about 10 acres in extent, and it is hoped that the new works will be opened ready for operation by the beginning of next year. The steel rail trade has improved considerably, Messrs. Bolckow, Vaughan & Co. are reported to have secured an order for 25,000 tons of rails for the Transvaal Government.

Stockton and Thornaby.—Messrs. Richardson, Duck and Co. are reported to have secured the order to build a large cargo boat for Messrs. Farrar, Groves & Co., of London, and one for Messrs. Bell, Symondson & Co., London, for their River Plate trade, to carry about 5,500 tons deadweight on 20 ft. 6 in. draught, to be delivered in December, the engines and boilers to be built by Messrs. Blair, Ltd., also of Stockton. Messrs. R. Ropner & Sons have a fair share of work on hand and, generally, trade is better than it has been for some months. Recently Sir Samuel Sadler, chairman of the Tees Port Sanitary Authority, at one of their meetings commented on the remarkable state of activity of shipping at the port; the dock accommodation provided by the N.E.R. Co. being utterly inadequate for the demand upon it, so many large steamers were coming into the river for bunkers that they had to wait sometimes for days before they could get a berth.

West Hartlepool.—It was expected that Messrs. W. Gray and Co., who recently built two steamers for the Great Central Railway Co., of Grimsby (the Abbey steamers), would have secured the contract to build a third steamer which, I understand, has been secured by Messrs. Earle's, of Hull. She is to be about 265 ft. by 35 ft. by 18 ft. deep, and 13 knots for their cargo and passenger trade. Messrs. Gray & Co. are reported to have secured contracts to build four steamers, two of moderate size and two of about 9000 tons deadweight, also a cargo steamer for Messrs. Michalinos & Co., London, to carry 5,200 tons deadweight on 20ft. 6in. draught, the engines and boilers to be built at their Central Marine Engine Works. They have also been fairly busy in the repair department at both yards, their Central Marine Engine Works are also busier than they have been for some time. Messrs. Irvine's Shipbuilding Dry Dock Co.'s Harbour Yard are completing the second steamer for Messrs. Elder, Dempster & Co., Liverpool, also a small steamer for foreign owners. They have been fairly busy docking, repairing, etc.

Hartlepool.—Messrs. Irvine's Shipbuilding and Dry Dock Co.'s Middleton yard may now be said to be busy. Besides the work on hand they are preparing for the three large boats recently placed with them by Sir Alfred Jones, of Messrs. Elder, Dempster & Co. They are also reported to have secured an order to build a large cargo steamer of about 7500 tons deadweight for Liverpool owners. The s.s. *Netherton* is still in dock, negotiations for repairing her having nearly fallen through, it being considered difficult and expensive to repair her.

The s.s. *Headley*, a ship built by Messrs. W. Gray & Co., and engined at their Central Marine Engine Works, claims the world's record for consecutive steaming. On July 25th she arrived at the Navy Yard, Pungent Sound, with a cargo of coal, sixty-eight days from Newport News. From the time she left Newport News on May 18th at 6 p.m., until

she arrived inside Cape Flattery her engines had not slowed down or stopped, according to her officers, so that the vessel covered 14,638 miles on the run. This performance is stated to eclipse all others. Captain Butler described the trip as a very lonely one. Only two vessels were sighted all the way. Mr. J. Hughes, the chief engineer, is to be highly complimented and the performance also speaks well for the work turned out by Messrs. W. Gray & Co. Messrs. Richardsons, Westgarth & Co. are fairly busy. In the foundry they have been very busy and ultimately could not cope with the extra work from their Middlesbrough works, which have now restarted. Besides the three sets of machinery for Messrs. Elder, Dempster's boats building by Messrs. Irvine's Shipbuilding and Dry Dock Co., they are reported to have secured the contract to engine a large twin-screw steamer to be built by Messrs. Swan & Hunter, Wallsend-on-Tyne, for Liverpool owners. They are also very busy with contracts and enquiries for their contraflo condenser, which has come so rapidly to the fore for marine work. They are also busy with their condensing plants where this type of Contraflo condenser is used. Generally trade seems to be better, as prices are now at rock bottom with a tendency to rise, enquiries for special steamers being fairly numerous since the holidays, and the outlook is certainly brighter for the winter months.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

The New River-Side Quay is now in full working order; the Continental steamers now come alongside the Quay at all states of the tide direct from sea and land their passengers and cargoes. This is a great convenience to the general travellers and fruit merchants, who get their fruit landed at once, sold by the auctioneer, packed into the railway vans, and delivered into the Midland districts. There is an up-to-date station. The boat trains from King's Cross deliver the passengers alongside the boats. A service of steamers of the Hull and Netherland Steamship Co., splendid steamers for passengers, sails daily, 6 p.m., to Rotterdam. Also the *Duke of Clarence* sails three times per week for Zeebrugge, in Belgium, and the well-appointed passenger steamers of the Wilson Line for Christiania, Norway, Gothenburg, Bergen, Stavanger, etc. We have also visits of the A. Class of steamers of the R.M.S.P. Southampton, calling for passengers during the tourist season, cruising Norway and Sweden. The new quay has cost the North-Eastern Railway Co. a great amount of money.

Earle's Shipbuilding and Engineering Co., Ltd.—This firm has been kept fairly busy with repair work. They docked the Austrian steamer *Kossuth Ferinz*, of Fiume, which was mentioned in our report last month; the ship had gone ashore on the Goodwin Sands. She has been fully repaired and put again into commission and sailed for Fiume. The Wilson liner *Dago*, which also was reported in our last month's issue, having been ashore on the rocks in the Baltic, the owners have put the work of steamer in this firm's hands to repair, and have decided also to lengthen her 16 feet, at present she has been parted for this length. The cost of repairs, etc., will be very heavy before she again appears in commission. It is reported that the amount the Admiralty has put aside for building the Tug-boat is nearly £32,000 to £33,000, the rumour last month was £24,000. The firm has been successful in obtaining a contract, to built two continental passenger steamers for the Great Central Railway Company, of Grimsby; this will greatly add to this Company's fleet, which runs to all principal ports on the Continent, such as Hamburg, Rotterdam, Antwerp. It is also reported that they have been successful in obtaining and securing the contract to build a 300 feet steamer, for the Wilson Line, for their Mediterranean and Baltic trades.

Central Dry Dock and Engineering Co., Ltd.—This particular firm seem always in full swing with repair work. They have in their dock the ss. *Elswick*, for a new stem and a complete overhaul, which will amount to a heavy figure; also the ss. *Saltmarshe*, of Goole, having been ashore in the Humber, they repaired her and she is again in commission, and to-day are docking the steamer *Hessle*, of Goole, which has been run into during a fog in the Channel, and will necessitate a good round sum expended on her before she will again take her turn in the sailings. Besides keeping their own dry dock in full work, they invariably have to apply to the North-Eastern Railway Co., and Hull and Barnsley Railway Co., for the use of their large dry docks, Albert Dock and Alexandra Docks.

Humber Ironworks.—This firm is very slack, and have slips to accommodate 2,000-ton ships. They have only a few men on at present.

Messrs. Amos & Smith, Engineers and Boilermakers.—This firm has been successful in obtaining the contract, engine and boilers for a new steamer being built by Earle's Shipbuilding Company, for the Wilson Line; they are finishing two trawlers, and are also successful in obtaining orders, from abroad, for their auxiliary engines, and their splendid patent steam-steering gears.

Messrs. Cooper & Co., Engineers and Boilermakers, have been very successful in docking and repair work, and engage many different tradesmen in their works and in the docks.

Messrs. Stewart & Craig, Engineers and Boilermakers.—This firm seem to keep forging ahead, and steadily gaining ground in the general repair work, around the docks.

Messrs. Cook, Welton & Gemmell, Shipbuilders, Beverley.—This firm is, like many others on the East coast, suffering from the lack of fresh orders. They have been very successful in building trawlers for Grimsby and Hull owners, but at present things are very unremunerative with the trawler owners, they seemingly will not build at the present, prices for fish, etc., being at very low rates, and great expense incurred through having to send their vessels so far from England to catch fish.

Messrs. Gemmell & Frow, Engineers and Ironmoulders.—This firm is fairly busy building steam capstans, windlasses and steam-steering gear for home and foreign owners.

It is reported that the Goole Shipbuilding and Repairing Company, Limited, Goole, have recently booked orders for two steamers, one a handy light draught cargo and passenger steamer, for the Borneo Company Limited, London, for the Sarawak Coasting service. She is to be built from the specifications of Messrs. Flannery, Baggallay, and Johnson, and will be 150 ft. over-all, 25 ft. breadth, and 9 ft. moulded depth, and is to carry about 230 ton deadweight, with engines by Messrs. Richardsons, Westgarth & Co., Middlesbrough. Engines 18 in. and 36 in. by 20 in. stroke. The other vessel is a small cargo steamer for East coast owners.

Messrs. Cochrane & Sons, Ouse Shipbuilding Yard, Selby.—This firm has a large trawler to build for Portuguese owners. She has to be up-to-date in every detail. Also two trawlers for local companies. They are building an 850-ton steamer for a Hull owner for the East Coast trade. Engines by Messrs. C. D. Holmes & Co., Hull.

Warren & Co. Shipbuilders, New Holland, Lincolnshire.—This firm has been kept fairly busy building steel lighters for local owners, for the Ouse and Humber trade.

THAMES.

(From our Own Correspondent.)

Shipbuilding Work.—It is well-known that with the closing of works on the London river there is not the opportunity there formerly was to report much progress in this department, the Thames ironworks being the chief representative remaining on the river. By the First Lord's answer in Parliament to a question, however, there would appear to be a chance of a "Dreadnought" hull being given to the firm if the necessary plant is put down to accomplish the work within the specified time after launching. It is to be hoped in many ways that it will be possible to place such an order. That there is the mention of it is something.

Surrey Commercial Dock Report.—The 80th ordinary meeting of this Company has been held and as some questions have arisen with regard to dividend, owing to the transfer to the Port Authority, the opinion of the Courts had to be taken thereupon. The fact, as regards this Company, that the appointed day of transfer was changed from January 1st to March 31st, has acted adversely to them as it has brought in a lean last quarter and one which is invariably the worst

of the year, not leaving sufficient in this case to pay interest on the debenture stock and therefore necessitating drawing upon the balance available to December 31st. However a decision has been come to as to the division and this meeting of the Company is, therefore, the final one.

Steamship Reports.—While four of the five new vessels of the Orient Line are making their maiden voyages, three to Australia and one on a pleasure cruise, there only remains the fifth, the *Orvieto*, to come into service, and she is due to leave London on December 24th next. Meanwhile we have to report the loss of a first-class liner in the wreck at the Cape of the Shaw Savill boat, the *Maori*. Unhappily the wreck was attended with considerable loss of life.

Thames Steamboats.—With fourteen of these boats still unsold the Council, through their auctioneers, had an offer submitted for the lot of £5,500, and the Highways Committee advised that it be accepted, making a total amount realized for the thirty boats of £18,204. As regards the piers seventeen will revert, on October 31st next, to the Port of London Authority as the successors of the Thames Conservancy, while ten others will remain the property of the Council upon which a future decision will be made. Meantime, the fourteen boats may possibly inaugurate a private service on the river and written down to the low figure and in non-municipal hands with less expenses there may be a chance of success, but after repeated attempts we fear there can be no great future for such an enterprise. Two of the boats sold first, the *Purcell* and *Boydell*, are already in the Mediterranean on their way to the Danube, where they are to be employed.

The New Blackfriars Bridge.—This great work is nearing completion, though the time specified in the contract was the beginning of next year. The contractors, Sir W. Arrol & Co., will therefore be entitled to a bonus for the expedition displayed. The double line of tramways is laid and the connecting links pushed forward. The disturbance and removal of sewage pipes and telephone cables has been a large undertaking alone. This bridge will be the widest over the Thames, *viz.*: 105 ft. from parapet to parapet, giving a 73 ft. roadway. September 15th has been fixed for the opening ceremony and the City Corporation, which has spent £200,000 over the undertaking, will be likely to mark the event as an important one.

The Port of Dover.—The completion of the new harbour works enables us to note the progress that is being made at this port, and recently the advent there of a new vessel belonging to the Royal Holland Lloyd boats, running from Amsterdam to French, Spanish and Portuguese ports, and thence to some of the principal ports in the Brazil and Argentina. The new vessel is named *Frisia*, and has accommodation for about 1,400 passengers and is fitted with wireless telegraphy, submarine signalling, and carries an electrical laundry. The Red Star Line from Antwerp to New York continues to make Dover a port of call.

SOUTHAMPTON.

(*From our own Correspondent*).

Messrs. Day, Summers & Co., Ltd., Northam Iron Works, were busy last month carrying out alterations and painting the auxiliary s.y. *Kawala* (owner Prince Joseph Kamal, of Egypt). The firm has just booked an order for a twin-screw tugboat for the Southampton Steam Towing Co., similar to the tug *Hector*, which they built for the same Company about six years ago. The *Hector* is the most powerful tug at present in the port. The twin-screw tugboat *Hercules*, owned by the same Towing Co., is at present at the yard for damage repairs, and extensive repairs to the boilers.

Last month the Houlder Liner ss. *Oswestry Grange* put into Southampton with her port engine propeller shaft badly bent. About 3,000 tons of cargo had to be removed before the vessel went into dry dock, where a new propeller shaft was fitted, after which she was undocked and the cargo reshipped, and the vessel proceeded on her voyage to Queensland. On arrival here she had about 400 emigrants aboard, and these were temporarily accommodated at various hotels in the town pending the completion of the repairs.

The Royal Mail Steam Packet Co.'s *Amazon* arrived here on the 21st of last month, having completed her Norwegian Cruises, and will now resume her position in the Company's Brazil and River Plate service. The same Company's West Indian mail steamer *Orinoco* also arrived about the beginning of August, and after discharging her cargo proceeded into the inner dock to lay up. Her place on the West Indian New York service has been taken by the ss. *Oruba*, which vessel was last regularly engaged in the fortnightly Australian service, in which the Company ran four steamers conjointly with the Orient Line.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

THE engineering trade in this port during the past month has shown a decided improvement, and there is every sign of it continuing to do so for some considerable time, although things are still much below their normal condition. A large number of vessels have visited the port for repairs or renewals, and practically all the yards here have had their full share of the work.

At the moment of writing, Messrs. Cammell, Laird & Co., Ltd., are not quite so busy as they have been, but this is owing to the fact that a good many of the contracts they have on hand are now nearing completion, notably the new Nelson liner, the work on which has progressed very rapidly. Messrs. Cammell, Laird & Co. have also despatched two tugs for Spanish owners, the *Don Eduardo* and the *Don Thomas*. Both these tugs are built to Lloyd's highest class, and constitute a distinct advance in the designing and outfitting of tug boats. A fairly large hold is provided just aft of the forecastle, which is insulated, so as to carry a large supply of provisions. They are fitted with twin-screw compound surface-condensing engines, with cylinders 10 in. and 20 in. by 14 in. stroke, taking steam from two multitubular boilers working at 140 lbs. pressure.

Messrs. H. & C. Grayson, Ltd.—These people also have had a large number of repair contracts on hand, most of which are more or less of a small nature. They are carrying out extensive overhauls and renewals to the Houlder liner *Thorpe Grange*. At their Birkenhead works Messrs. Grayson have just completed a large repair contract to the s.s. *Pondo*, and they have also the steamer *Deansgate* at present in their dry dock undergoing repair.

Messrs. Clover, Clayton & Co., Ltd., have been very busy with several large contracts, which include the Newcastle steamer *Kenilworth* and the s.s. *Edward Dawson*, of Middlesbrough. Amongst other items the *Kenilworth* is having new crank, thrust and tail shafts throughout, and the *Edward Dawson* is being fitted with new furnaces. Messrs. Clover, Clayton and Co. have also at the time of writing three steamers belonging to Messrs. A. Rowland & Co. and two Birkenhead ferry boats, all undergoing repairs or renewals of a more or less extensive nature.

Cunard Line have asked tenders for a new steamer to replace the *Slavonia*, which was recently wrecked at the Azores. Several firms on the North-east coast, the Clyde and Belfast have been asked to quote, and I understand that a Liverpool firm have been asked to tender for the engines. I understand that tenders will be in about the 20th inst., so that at the time of writing no definite information is available. It is believed that this new vessel will include considerable improvements upon the lost *Slavonia*, and a rumour is current that the propelling machinery will be a combination of turbine and reciprocating engines, similar to those in the White Star Line's new steamer *Laurentic*.

The Cunard Line have also advanced another step in their progress by making Fishguard their port of call for eastward-bound steamers from New York, as is now well known through the daily press. This departure they claim will enable them to create a new record for the landing of passengers in London from New York, saving a matter of perhaps half a day in the journey from New York to London. The *Mauretania* sailed from here on the 14th August, and will on her return journey be the first to inaugurate this new service, and I believe special arrangements have been made at Fishguard to give the liner a great reception, and the town will be *en fête*. She will leave New York on the Wednesday as usual, calling at Fishguard *en route* for Liverpool, so that London passengers may disembark there and proceed to London by

means of the special arrangements which have been made by the Great Western Railway Co., to meet incoming liners. The passengers will thus arrive in London on the Monday night, whereas previously the liners did not arrive in Liverpool until Monday midnight or Tuesday morning.

Mr. E. C. Thin.—This gentleman has placed an order (through Messrs. H. E. Moss & Co.) for a large steamer of about 8000 tons deadweight, with Messrs. Armstrong, Whitworth and Co. The speed is to be about 12 knots.

Messrs. R. & J. H. Rea.—Messrs. Sir Raylton Dixon & Co. have received an order from these people for a new steamer. I understand that the vessel is to be a duplicate of the one this firm have now on order for the same owners. Engines will be built by Messrs. Richardsons, Westgarth & Co., Ltd., of Hartlepool.

Messrs. James Chambers & Co. have placed an order with Messrs. W. Hamilton & Co., of Port Glasgow, for a new steamer of about 7500 tons deadweight, to be built on the Isherwood longitudinal system of construction.

I also understand that the Ellerman Lines, Ltd., have contracted with Messrs. Barclay, Curle & Co. for a new steamer.

Canadian Pacific Railway Co.—I learn that these people are going in for a new steamer for their Lake service in Canada. The vessel is to be about 210 ft. long.

London & North-Western Railway Co. will shortly be entering the market for two new boats for the Holyhead and Dublin service. Up to the time of writing, the specifications have not yet been issued.

Messrs. M. Langlands & Sons.—I believe this firm are about to place an order for a new steamer, but no definite information is available.

Booth Steamship Co., Ltd.—This firm have placed an order for a duplicate vessel to that ordered a short time ago from Messrs. Barclay Curle & Co., Ltd.

Messrs. T. B. Royden & Co.—With reference to the two new steamers for these people I learn that one of these has just been placed with Messrs. Swan, Hunter & Wigham Richardson, with engines by Messrs. Richardsons, Westgarth & Co., Ltd., of Hartlepool.

The New "Dreadnoughts."—The order for the armour plating for the four new "Dreadnoughts" has been equally divided amongst five firms, amongst whom are Messrs. Cammell, Laird & Co., who have received the order for one-fifth.

New Dock Board Dredger "Leviathan."—Some interesting figures were given in the report of the Mersey Docks and Harbour Board concerning the performance of this new dredger, which commenced work in March last. It is stated that in a period of twenty-four hours she removed 70,000 tons of sand, and in the course of a week of 5½ days disposed of over 300,000 tons. The same report also gives some remarkable figures regarding the dredging of the Mersey Bar, and it appears that since 1890 over 40,054,590 tons have been removed from the Bar, which, added to that taken from the Queen's and Crosby channels (*viz.*, 93,607,860 tons) gives the huge total of 133,662,450 tons from the Mersey Estuary.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow-in-Furness.

DURING the past month there have been some very startling rumours which have emanated from Newcastle. One was to the effect that Vickers' at Barrow and Armstrong's at Newcastle, had each received orders from the Admiralty for one of the super Dreadnoughts, and the other was that Vickers' had booked an order for a huge floating dock, which was one of the several required for British Naval purposes. Neither report was confirmed, and for a very good reason. No orders have been received by either firm for the above. It is far too soon to talk about the big "Dreadnoughts" yet. On the other hand the correspondent will not be far out of it at the finish. There can be no doubt that Vickers' will be one of the firms to receive an order for one of the new "Dreadnoughts," and although, according to Mr. McKenna, the keels will be laid in March of next year we shall know who are building these new vessels a good three months before that. The super "Dreadnought" requires a lot of work on her designs before the builders can get on with them. We are told, and it may be safely taken for granted, that the 13·5 in. gun is to be introduced into the new vessels. This means a different vessel altogether, stronger in every way, longer and broader. Some time and considerable pains will have to be taken with the designs for these vessels, for it is intended that they shall carry ten guns mounted in couples, and that all shall be able to fire on either broadside. The firms of Vickers' and Armstrong's are at work on the guns now, in order that there will be no delay and there are other items in connection with these ships that are already in hand. Further than this the firms who are to receive the orders outside the Admiralty Dockyard probably know about it now, and are quietly making arrangements for the putting of them down in due course. It will hardly be a case of tendering for them. Probably it will be the same as when the first "Dreadnought" cruisers were ordered, there will be a special arrangement between the contractors and the Admiralty.

With regard to the alleged orders for a floating dock, there is nothing to show that such orders have been put in hand. It would be a good thing for Barrow if it were so and, of course, the order may come later, but at the moment nothing is known in the works, although some of the heads may know all about it. Floating docks of "Dreadnought" capacity are certainly needed, and the sooner they are ordered the better. The Admiralty might also order at the same time a vessel which should be of certain design which would enable it to raise a sunken submarine. The Germans have a vessel of this class, although the number of submarines they possess is nothing to be compared with this country.

According to a cable from Rio de Janeiro, the Brazilian Government have ordered from Vickers' Company a floating dock capable of lifting the battleships which are at present completing at Barrow and Newcastle, that is to say, with a lifting capacity of something like 25,000 tons. This order has been in the market for some time and there has been some competition for it. Vickers' of late years have devoted some attention to floating dock construction on the Clark and Standfields pattern, but what they have turned out have been small as compared with the one just ordered. They are building one for Aberdeen which shall be capable of lifting three steam trawlers at once. The Brazilian will be on the self-docking principle, that is, it will be in three sections, two of which can lift the third should any repairs be necessary. It will mean a considerable amount of work for Barrow and it will be very welcome. Vickers, Son and Maxim some time ago marked out the ground for this dock, and it looked then that there was more than a mere chance of the order coming this way.

Two submarines of the "C" class have been completed, and have been delivered to the Admiralty. They were the "57" and "58." There are two more "C's" completing at the wharf and it looks as if that class would finish then. There will be then, when Chatham has completed its few, no less than thirty of the "C" class. There is another submarine completing at the wharf which is the "01" or "D1." This vessel is of altogether a different design. She has trimming tanks built out from the sides of the main structure, is longer, twin-screws and possesses three torpedo tubes—two in the bow and one aft. This vessel has already been out to sea to take her trials which are said to have been very satisfactory indeed. At any rate, there is every reason to believe that the "D" class improved is to be gone on with now and it is even possible that at the present time one or more are being built in the shed. The object with the new vessels will be to make them larger with a bigger oil or spirit storage, so that they will have a bigger radius of action. Another improvement which it will only take time to perfect is the new engine. There can be no doubt about it that petrol engines are not very safe owing to the vapours given off. The builders at present are earnestly engaged upon an engine which will use a different class of oil and which will give the same, if not better results than the petrol engine.

The large mountings and some of the 12-inch are being placed into the *Vanguard*, so it would appear that the inspection last month was satisfactory. There has been no hitch in the placing of these huge weights into the vessel. The *Vanguard* is gradually getting to look more finished and no time is being lost. The builders are hoping to have her

so far advanced that they propose at the end of October to take her out for her first or builders' trials. At the moment there does not seem any reason why they should not. After she has been dry-docked in the Clyde she will take her trials and then return to Barrow to be completed ready for her official trials in or about February or March next year. It is hoped that it will be February.

The Brazilian battleship *Sao Paulo* is not coming on so fast, but there will be no delay about her. She will get her turn when the heavy work has been completed on the *Vanguard*. The armour protection of the six-inch gun batteries amidships is now being fastened on and work is also proceeding with her big gun positions. The engines for this ship are ready to be placed in the vessel and there will be no delay in connection with these or the boilers either. There is nothing new about the proposed third Brazilian "Dreadnought," although report had it that the order had been placed and that Armstrong's were about to lay the keel. Of course, if this order comes along Vickers' will have the work of constructing her engines and boilers.

The Canadian Ice-breaker *Earl Grey* is nearly ready and she is beginning to look very smart indeed. Despite her great beam in comparison to her length she presents a fine picture, and the Dominion of Canada have every reason to be proud of her. Her passenger accommodation is lavish to say the least. It will not be long before she takes her trials. She has already had a run out of her engines in the dock when everything acted satisfactorily.

The construction of the naval airship is proceeding, and the piles on which the nearly 600 ft. shed will rest in the Cavendish Dock are being put in now. There has been some delay in getting the piles in owing to bad foundations, but this has now been overcome, and it will not be long before Messrs. Francis Morton are engaged erecting the iron shed.

This airship is to be of the Zeppelin design, rigid, and will, it is said, carry twenty hands. There is to be, I am told, an important development in regard to power of this dirigible which will give her more scope in varying weathers. It looks as if Barrow were about to enter into a new line and that airship construction is to become a new industry. If one takes the case of the submarine which was first built in this country, and which has now become an important branch at Vickers' works, there can be no doubt as to the future of the airships in connection with Barrow. There is one significant thing—Vickers' have leased the Cavendish Dock, which is 146 acres in extent, from the Furness Railway.

There is a rumour going about that the Cunard Company are inviting tenders for the construction of a large vessel—as big as the *Mauretania*. It is known that Vickers' through the fact that the dock passageway was not wide enough to accommodate this class of vessel lost an order for one of the last flyers and now that this difficulty has been overcome, there seems no reason why Vickers' should not stand a very good chance of securing the order. It is said that only the Tyne and the Clyde are tendering, but there is no reason why Vickers' should not be able to tender also. There is not a better yard in the world for the building of large ocean passenger vessels than Vickers', at Barrow, whose appliances are of the very latest type and of the best. Such an order would be a great thing for Barrow in more than one sense. It has been difficult to get this work at Barrow up to now, and it is more than possible that if they could get in they would make their name, and be able to secure other orders of a similar character, in the future. I have since learned that the *Cunarder* is to be 600 feet long, and have a speed of 16 knots, and that the propelling machinery is to be a combination of reciprocating engines and low-pressure turbine similar to the *Otaki*.

Hæmatites.—There is a better prospect in the hæmatite iron trade and at the time of writing prices are becoming more buoyant. Makers are asking 60/- per ton net f.o.b. for ordinary mixed Bessemer numbers while in the warrant market iron has risen to 6[illegible] sellers and is still rising. The steel trade is only moderate. The West Cumberland combine have got into working order, and have started the No. 1 mill at Derwent works. The rail and fish plate mills at Barrow are working. Orders are not very plentiful. There is nothing doing at all in the shipbuilding material departments. Mr. J. M. While, who has been 18 years manager of the Barrow Steel Works, is retiring at the end of this year.

BELFAST.

(*From our own Correspondent.*)

Messrs. Harland & Wolff.—At time of writing the Wilson's and Furness-Leyland liner *Meltonian* is down the Lough for her trial trip. The *Meltonian*, as mentioned in last month's notes, is a sister-ship of the *Median*, *Memphian* and *Mercian*, already constructed at the Queen's Island for the same owners, and is propelled by a set of quadruple-expansion engines. The departure of this vessel will be followed a week or two hence by that of the *Leicestershire*, which is the latest addition to the well-known fleet of the Bibby Line. The completion of this vessel will leave Messrs. Harland and Wolff without any new tonnage afloat, for they will have nothing ready for launching for some time to come. The White Star liner *Olympic's* huge stern-frame, which recently arrived in Belfast per Antrim Iron Ore Co.'s s.s. *Glendun*, is now erected in its place. The weight of the stern-frame alone is over seventy tons, while the brackets for the wing propellers weigh fifty tons. When being brought from the Darlington Forge Co.'s works to West Hartlepool, a twenty-five ton steam travelling crane was sent with the train to take the strain of the overhanging boss, the outreach being so great that both sets of rails had to be kept clear of all traffic to enable the big casting to pass. It took the entire day to accomplish the short journey of twenty odd miles between Darlington and West Hartlepool.

Messrs. Workman, Clark & Co.—This firm has launched two vessels during the month: the fruit steamer *Almirante* for the Tropical Fruit Steamship Company, Ltd., Glasgow, and the *Star of Canada* for Messrs. J. P. Corry & Co., London. The *Almirante* is the tenth vessel built by Messrs. Workman, Clark & Co., for the same owners, and they have a further three on hands. She is 394 feet long, with a gross tonnage of about 5,500 tons. In addition to the specially-arranged cargo space for the carriage of fruit, the new vessel has luxurious accommodation for over 100 passengers. The engines are triple-expansion, and steam is supplied by five single-ended boilers working under forced draught. The *Star of Canada* is a fine twin-screw vessel of 470 feet in length, and the propelling machinery consists of two sets of triple-expansion engines having cylinders 22in., 37 in. and 62 in. by 45 in. stroke. All the vessels of the well-known Star Line have come from the same builders' hands, and the *Star of Canada* is the first of the fleet to be fitted with twin-screw machinery. Messrs. Workman, Clark & Co. are at length getting rid of their Lloyd Brazilleiro steamers. It will be remembered that when the time came for payment for these vessels and others building elsewhere for this concern, the Lloyd Brazilleiro money was *non est*, and the shipbuilders were left in the unfortunate position of having the steamers left upon their hands—a whole fleet in the Belfast firm's case. It was reported a short time ago that a company had been formed in London to take over the steamers. Be this as it may, one has already left Belfast, and work is proceeding on the others, both afloat and on the stocks.

Since writing the above, we learn that the money required for taking over the Lloyd Brazilleiro boats has been raised in Brazil

Motor Ferry-Boat at Aberdeen.—A motor ferry-boat of somewhat original design for passenger service in the Aberdeen harbour, basins, docks, and on the river Dee, has recently been put into service. She is of the double-ended type, designed to carry thirty passengers, her dimensions being 40 ft. over all by 9 ft 6 in. beam, and 4 ft. depth. The draught, with a full complement of passengers and attendants, is 3 ft. 6 in., and with full complement of passengers the working speed is $6\frac{1}{2}$ knots. The machinery consists of one set of Thornycroft M. 4 type marine motors, four cylinders, $4\frac{1}{2}$ in. bore by 6 in. stroke. The fuel may be either kerosene or paraffin. The power is transmitted to a shaft carrying a propeller on either end, both propellers being worked at the same time. The transmission is by means of a clutch and silent chain drive in one direction, and by a clutch and gear in the other, the movement either forward or reverse being controlled by one lever and one operation. The boat has been built throughout under the supervision of the Board of Trade and the Engineer to the Aberdeen Harbour Commissioners.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Thessaly.—On June 3rd, Messrs. Richardson, Duck and Co. launched from their shipbuilding yard at Stockton-on-Tees a finely-modelled steel screw steamer with three complete steel decks. This vessel has been built to take the highest class in the British Corporation Registry and is constructed on the Isherwood system. The vessel has been built to the order of Messrs. David MacIver, Sons and Co., Ltd., of Liverpool, and is a duplicate vessel to the s.s. *Gascony*. The general particulars of this vessel, which is a shelter-deck steamer with three complete decks, are as follows:—Length overall, 373 ft. 6 in.; breadth extreme, 48 ft.; depth moulded to shelter deck, 31 ft. 6 in.; gross tonnage, about 3,133 tons. The vessel will be fitted with engines by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, of the following sizes, *viz.*, 26 in., 42½ in., 69½ in. by 45 in., with three boilers 15 ft. 9 in. by 10 ft. 3 in., 180 lbs. pressure, which are expected to drive her a speed of 11 knots in ordinary working at sea. Special attention has been paid to the loading and discharging arrangements, which include ten steam winches by Messrs. Clarke, Chapman & Co., large horizontal multitubular donkey boiler, a full outfit of derricks, including four steel tubular derricks, supplied by the British Mannesmann Tube Co., Ltd., two to lift 20 tons each and two to lift 15 tons each. Electric light will be fitted throughout by Messrs. J. H. Holmes & Co., Newcastle.

Hartside.—On June 3rd, Messrs. Short Brothers, Ltd., launched from their shipbuilding yard at Pallion, Sunderland, the s.s. *Hartside*, built to the order of The Charlton Steam Shipping Co., Ltd. The vessel, which will take the highest class at Lloyd's, is 325 ft. in length, 47 ft. beam and 23 ft. ½ in. depth moulded, and is designed to carry a cargo of 4,800 tons on a moderate draught of water. She is constructed on the deep frame principle, with one deck laid, poop and topgallant forecastle. Six steam winches, steam windlass, steam-steering gear amidships with rods and chains to quadrant and controlled from standards on flying bridge are fitted, all driven from a large donkey boiler fitted on main deck. Hand-steering gear is fitted aft. The propelling machinery is by Messrs. John Dickinson & Sons, Ltd., Sunderland, and consists of engines with cylinders 23 in., 38 in., 62 in. diameter, with a stroke of 42 in., driven by two large multitubular boilers working at 180 lbs. pressure.

Tynemouth.—On June 3rd, there was successfully launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Ltd., Bill Quay-on-Tyne, a new steel screw steamer which has been built by them to the order of Messrs. The Burnett Steamship Co., Ltd., Newcastle-on-Tyne. The vessel has been constructed to the requirements and under the special survey of Lloyd's for their highest classification, and is of the long raised quarter-deck type with long bridge and topgallant forecastle. She has specially large hatches for self-trimming and will be fitted with the latest improvements and appliances for facilitating the rapid loading and discharging of cargo. The machinery has been constructed and will be fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, and consists of a set of triple-expansion engines supplied with steam by two large steel multitubular boilers.

Mapleton.—On June 4th, there was launched from the yard of the Sunderland Shipbuilding Co., Ltd., a steel screw steamer 250 ft. in length between perpendiculars by 42 ft. 6 in. broad by 18 ft. 6 in. deep. The vessel is of the single-deck type and will take the highest class in British Corporation for the Great Lake service. The deck machinery consists of steam winches, steam-steering gear and direct steam capstan windlass. A complete installation of electric light is fitted. The main engines are by the North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 17 in., 28 in. and 46 in. by 33 in. stroke, steam being supplied by two large boilers working at a pressure of 185 lbs. per square in. The vessel has been built to the order of Messrs. the Merchants' Steamship Co., Ltd., Toronto, Canada.

Belt Discharging Steamer.—On June 4th, Messrs. Wm. Doxford & Sons, Ltd., launched from their yard at Pallion a single-deck steamer of 270 ft. length, 44½ ft. breadth, and 23½ ft. moulded depth. The vessel is of steel, with engine-room aft and is classed with the British Corporation. A special interest lies in the new system of discharging the entire cargo—coal, iron ore or other mineral—by means of two continuous, revolving trough-shaped belts, carried in suitable trunks under the entire length of all the holds, and gradually rising aft to the deck level, at which point by means of a secondary system of inclined belting and swinging tubular booms the cargo is discharged into lighters alongside or into trucks on the landing quays. This application of belt-discharge, which Messrs. Doxford have patented and introduced, is almost entirely automatic, the services of only two men being required to regulate the transport of the cargo from the vessel's hold to the lighter or railway truck, at the exceptional speed of 500 tons per hour—and it is weighed automatically, too, *en route*.

Haller.—On June 5th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely-modelled steel screw coasting steamer, the principal dimensions being 178 ft. by 30 ft. by 14 ft. 6 in. moulded. The vessel has been built to the order of Messrs. G. R. Haller, Ltd., of Hull, and will be fitted with powerful triple-expansion engines 16 in., 26½ in., 43 in. by 30 in., with two boilers 12 ft. 6 in. by 10 ft., 180 lbs. pressure, by Messrs. C. D. Holmes & Co., Ltd., of Hull, and is replete with all the latest improvements for this class of vessel.

Napoliana.—On June 7th Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., launched from Middleton Shipyard, Hartlepool, the steel screw steamer *Napoliana*. She is 336 ft. in length, 47 ft. beam, with a depth of 24 ft. 10 in., of the single-deck type, having poop, bridge and topgallant forecastle, and built to the highest class in Lloyd's Register. Cellular double bottom is fitted throughout and the fore and after peaks are arranged as trimming tanks; she is constructed with deep frames and longitudinal stringers, giving clear holds for the bulky stowage of cargo. The vessel is divided into six compartments by means of five water-tight bulkheads, and wood grain divisions are fitted in the holds. Extra large cargo hatches are fitted, five steam winches worked from a multitubular donkey boiler, and all the latest improvements are included in the outfit of the vessel. A powerful quick-warping steam windlass is fitted forward and steam-steering gear is fitted amidships, with hand-screw gear aft. Triple-expansion engines will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 23½ in., 38 in. 64 in. by 42 in. stroke, with two large single-ended boilers working at a pressure of 180 lbs. per square in.

Victor Hugo.—On June 17th, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough-on-Tees, the fine steel screw cargo steamer *Victor Hugo*, built on the well-known patent cantilever frame system to the order of Messrs. Delmas Frères of La Rochelle, to fulfil the special requirements of their coal-carrying trade. The vessel is being built to Lloyd's highest class under special survey and to comply with French Law requirements, with engines aft. Her leading dimensions are 301 ft. by 43 ft. by 21 ft. 4 in. moulded, and will carry about 3000 tons on 18 ft. 3 in. draught with a nett register of 1,300 tons. The holds are perfectly self-trimming and absolutely free from all obstructions such as beams, pillars or web frames. She has four holds, four large hatchways, 25 ft. wide, the longest of which is 35 ft. 5 in. Each of these hatchways is covered with portable steel covers which are easily removed in five lifts by the derricks and require no tarpaulin. The vessel will have two masts, four derricks, five steam winches, steam windlass, steam steering gear and all the latest and most modern appliances for the rapid handling of cargo. Triple-expansion engines placed aft having cylinders 22 in., 35 in. and 50 in. by 30 in. stroke with two large single-ended boilers, working at 180 lbs. pressure will be fitted by Messrs. Richardsons, Westgarth & Co., Ltd., of Middlesbrough. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Wm. Cory.—On June 17th, Messrs. S. P. Austin & Son, Ltd., launched from their shipbuilding and repairing establishment at the Wear Dock Yard, Sunderland, the steel screw steamer *Wm. Cory*, built to the order of Messrs.

William Cory & Son, Ltd., of London. The deadweight capacity will be about 4250 tons on a light draught of water, and she has large hatchways specially adapted for the owners' coal trade, fitted with every appliance for quick loading and discharging. The vessel is to be classed 100 A1 in Lloyd's Register under special survey, and will have large water ballast capacity. The machinery is of large power to be supplied by Messrs. George Clark, Ltd., Southwick Engine Works, Sunderland, and the auxiliary machinery is by other first-class makers. Wailes, Dove and Co.'s "Bitumastic" enamel was applied to the bunkers, and their "Bitumastic" covering to the tank top in boiler-room.

Washington.—On June 19th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 117 ft. by 21 ft. 6 in. by 12 ft. 3 in. moulded. The vessel has been built to the order of Messrs. The Premier Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes and Co., Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Breaksea.—On June 10th, the Goole Shipbuilding and Repairing Co., Ltd., launched from their Victoria Shipyard, Goole, a very handsomely modelled steel screw steamer of the following dimensions:—143 ft. B.P. by 23 ft. by 10 ft. 6 in. The vessel is of the long raised quarter-deck type, and raised forecastle, the captain being berthed amidships and the engineers aft. The vessel is being built to the order of Mr. R. Culley Walker, Barry Dock.

Boduognat.—On July 3rd, Messrs. Wm. Pickersgill and Sons, Ltd., launched from their shipbuilding yard at Southwick, Sunderland, a finely modelled screw steamer built to the order of the Antwerpsche-Zeevaart-Maatschappij Co., Ltd. (Messrs. J. D'Haeno & Co.), Antwerp. Her principal dimensions are:—Length, 259 ft.; breadth, 38 ft.; depth, 19 ft. 6 in., and she is built under special survey to take Germanischer Lloyd's highest class. The vessel is built on the deep bulb-angle frame principle, and is fitted with cellular bottom, while the after peak is also arranged for water ballast, and the fore-end strength is considerably increased to enable her to frequent ice-bound ports. Four large hatches are also arranged with winches and derricks for lifting heavy weights. The pillars at sides of hatches have been dispensed with, so as to leave large clear holds. She is also fitted with steam windlass, and steam-steering gear which is fitted in the engine casing with controlling shafting to wheel on bridge. The machinery is being supplied by Messrs. MacColl & Pollock, Ltd., of Sunderland, being of the triple-expansion type, having cylinders 18 in., 30 in., 49 in. by 33 in. stroke, steam for which will be supplied from two large steel boilers with a working pressure of 180 lbs.

Nero.—On July 5th, a handsomely modelled steamer built to the order of Messrs. Thomas Wilson, Sons & Co., Ltd., Hull, for their North Sea and Baltic trade, was launched from the yard of Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull. The principal dimensions are:—Length, 250 ft.; breadth, 35 ft.; depth, 18 ft. moulded. She has been constructed of steel to the British Corporation Registry's highest class, and to the Board of Trade latest requirements. The vessel is of single-deck type, with short poop, long bridge and topgallant forecastle, and will be fitted with two pole masts to suit Manchester Ship Canal regulations, and is capable of carrying a large quantity of water ballast. She will be fitted with all necessary derricks and cargo gear, four steam winches, steam windlass, steam and hand-stering gear.

LAUNCHES—Scotch.

Five Islands.—On August 3rd, Messrs. Napier & Miller, Ltd., launched from their yard at Old Kilpatrick, the steel screw steamer *Five Islands*, built to the order of the Mount Kembla Coal & Oil Co., Ltd., of Sydney, N.S.W., to carry 1400 tons on 14 ft. draught. Her principal dimensions are Length, 215 ft.; breadth, 33 ft.; depth, 16ft., with a gross tonnage of about 940 tons. The vessel, which has been specially designed for the rapid loading and discharging of coal cargoes, has four large self-trimming hatchways, clear holds, six friction winches for rapid working of coaling derricks. Provision is made for water ballast in double bottom and fore and aft peaks, electric light is also fitted throughout. The vessel has been built in excess of Lloyd's requirements for their highest class. The machinery which is fitted aft is being supplied by Messrs. D. Rowan & Co., and consists of triple-expansion engines having cylinders 16 in., 27 in., 44 in., with 30 in. stroke, also two main boilers of large size.

Romera.—On August 3rd, Messrs. Alex. Stephen & Sons, Ltd., Linthouse, launched a large new cargo steamer for Messrs. Maclay & McIntyre, Glasgow. The vessel has been built to Lloyd's highest class, and her dimensions are:—Length, 403 ft.; breadth, 52 ft.; depth, 30 ft. She has been designed and fitted out as a first-class deadweight carrier. The machinery, which has also been constructed at Linthouse, consists of a set of triple-expansion engines, having cylinders 25 in., 41 in. and 67 in. diameter, with a stroke of 51 in. and supplied with steam from three large single-ended boilers, fitted with Howden's forced draught.

Mataram.—On August 19th, there was launched from the works of the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, a steamer which has been built specially for the service of the well-known Australian shipping firm, Messrs. Burns, Philp & Co., Ltd., for their service between Sydney, Queensland ports, Java ports and Singapore. The dimensions of the vessel are:—Length, 331 ft.; breadth 43 ft.; depth, 24 ft. 9 in.; d.w. carrying capacity, about 4,200 tons; accommodation for sixty first-class passengers amidships, and twenty-two second-class. In view of development of the frozen meat, fish, fruit and butter trade between Australia and the East, the new steamer will be fitted with the latest refrigerating plant, her cold storage being equal to a capacity of 30,000 cubic feet, in four chambers. The new steamer will have four hatches and two powerful winches at each, and she will be fitted with Telemotor steam-steering gear and all the latest appliances for working the ship. The engines will be on the triple-expansion principle with cylinders 24 in., 40 in. and 60 in. in diameter, the length of stroke being 42 in. The electric light will be installed throughout, and electric fans will be fitted in all the cabins.

LAUNCHES—Irish.

Star of Canada.—Messrs. Workman, Clark & Co., Ltd., Belfast, have launched from their North Yard a large and handsomely designed twin-screw steamer, built by them to the order of Messrs. J. P. Corry & Co., London. The new steamer has been named *Star of Canada*. She is the ninth vessel built by this firm for the "Star" Line fleet, and is 470 ft. in length, with a gross tonnage of about 7,300. She has been specially designed and will be equipped for the conveyance of frozen meat and fruit from the Australian and New Zealand colonies. The cargo space is divided into five large holds, three of which are insulated and prepared for the reception of chilled and frozen meat cargoes. The arrangement for the preservation of these cargoes consists of a complete and efficient installation of refrigerating machinery. A large hatchway to each hold is provided with steam winches, derricks and other appliances necessary for handling heavy cargo. The propelling machinery consists of two sets of improved triple-expansion engines supplied with steam from four steel multitubular boilers working under forced draught. The vessel has been built under special survey for the highest class in Lloyd's Register of Shipping, and complies with the Board of Trade requirements for a first-class cargo steamer.

Almirante.—Messrs. Workman, Clark & Co., Ltd., Belfast, have launched from their South Yard the new steamer *Almirante*, built to the order of the Tropical Fruit Steamship Company, Ltd. (Messrs. Clark & Service Managers), Glasgow. The extremes of climate in which the vessel will trade have been provided against by an efficient installation of steam heating throughout the passenger and crew accommodation, and a system of ducts, by which cooled fresh air can be delivered to the various rooms as required, and electrically

driven fans have been installed in all the public and private rooms. The vessel is lighted throughout by electricity. The cargo space is divided into eight compartments thoroughly insulated and prepared for the carriage of fruit cargoes in bulk, and an extensive installation of refrigerating machinery has been arranged, by means of which these cargoes will be preserved in good marketable condition. Steam cranes, steam winches, derricks and other special appliances of the most improved description have been provided for handling the cargo. The propelling machinery consists of a set of triple-expansion engines, with steam from five single-ended steel multitubular boilers, working under an improved system of forced draught. The vessel has been constructed under special survey for the highest class in the British Corporation Registry of Shipping, and complies with the requirements of the British Board of Trade and the United States Steamship Inspection Service.

TRIAL TRIPS.

Relillio.—On June 22nd, the first-class cargo steamer built by Messrs. Robert Thompson & Sons, Ltd., Southwick Yard, to the order of Messrs. The Orders & Handford Steamship Co., Ltd., Newport, Mon. (the fourth vessel they have built for the same owners), was taken out to sea on her official trial. The runs on the measured mile were most successful, the speed results exceeding expectations.

Bismarck.—On July 10th, the steamship built by Messrs. Ropner & Sons, Ltd., of Stockton-on-Tees, made her official trial trip in the Tees Bay. The steamer has been built to the highest class in the British Corporation Registry, and is for foreign account. She is fitted with the builders' patent improved trunk deck, with two large clear holds and only two large hatchways. The vessel has been built under the superintendence of Captain Hansen, of Bergen, and on trial she behaved herself in a thoroughly satisfactory manner.

Retriever.—On July 10th, the cargo steamer was taken out to sea on her official trial trip, off the mouth of the Humber. The vessel has been built by The Goole Shipbuilding and Repairing Co., Ltd., Goole, to the order of Messrs. The West Coast of America Telegraph Co., Ltd., London, and is of the following dimensions: 185 ft. on load line by 28 ft. beam by 16 ft. depth moulded. She is specially designed for the repairing and laying of submarine cables. She has three cable tanks, special cable winch, bow gear, cable leads, etc., and all of the most modern and complete description. The exposed decks are made of teak. The machinery has been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., of Middlesbrough. During her trial a mean speed of over 10½ knots was obtained, and immediately after the trial the vessel sailed for London and averaged a speed of 10 knots all the way.

Borborema.—On July 10th, the steel screw steamer, built by Messrs. Craig, Taylor & Co., Limited, Stockton-on-Tees, to the order of Messrs. Lloyd Brazileiro, of Rio de Janeiro, and London, was taken to sea for her trial trip, which proved highly satisfactory. The vessel is of the following dimensions, *viz.*:—286 ft. by 44 ft. 9 in. by 17 ft. 6 in. depth moulded. She is designed to suit the special trade of the Lloyd Brazileiro, and is built under special survey to class with the British Corporation Registry. She is fitted with patent vertical steam windlass, with quick-warping ends, by Clarke, Chapman, Hastie's Wilson-Pirrie patent steam-steering gear, placed in house aft, and worked from bridge amidships by telemotor; eight steam winches; double derricks for rapid loading and discharging, with gins and blocks having Reid's patent sheaves; Clayton fire and disinfecting machinery; electric light by Siemens Brothers, and all modern improvements for a first-class cargo steamer for the Brazilian trade, including Wailes, Dove's patent bitumastic enamel to the tanks, Christie's patent sparring cleats, Litosilo to cabins, Hoskin's beds, whilst the lifeboats have Mills' disengaging gear. The machinery, which has been constructed by Messrs. Blair & Co., Ltd., Stockton-on-Tees, consists of two sets of triple-expansion engines 14, 22, 37, 24, with two large steel boilers working at 185 lbs. pressure, and during the whole of the run worked with the greatest smoothness, when a speed of 11 knots was maintained.

Hartside.—On July 7th, the s.s. *Hartside* lately launched by Messrs. Short Brothers Limited, from their shipyard at Pallion, Sunderland, to the order of the Charlton Steam Shipping Co., Ltd. (Messrs. Charlton, McAllum & Co., Managers), Newcastle-on-Tyne, left the Wear for her official trials. The propelling machinery, which throughout the trial worked very satisfactorily, is by Messrs. John Dickinson and Sons, Limited, Sunderland, and consists of engines with cylinders 23in. 38 in., 62 in. diameter by 42 in. stroke; taking steam from two large multitubular boilers working at 180 lbs. pressure. On the trial runs, with a full cargo on board, the steamer maintained a speed of 10 knots.

Atenas.—This new steamer left Belfast Harbour and after adjustment of compasses in the Carrick Roads, proceeded on her speed trials over the measured mile, which were highly successful, the vessel afterwards leaving the Lough for the West Indies. See launch in June issue.

Boduognat.—On July 24th, the s.s. *Boduognat*, the second steamer built by Messrs. Wm. Pickersgill & Sons, Ltd., of Southwick, Sunderland, to the order of the Antwerpsche Zeevaart Maatschappij Co., Ltd. (Messrs. J. D'Haene & Co.), Antwerp, left their yard for her trial trip. The trial trip was entirely successful, the machinery, which has been supplied by Messrs. MacColl & Pollock, Ltd., of Sunderland, giving an average speed of 11¼ knots on the measured mile. The owners were delighted with the steamer, and with the satisfactory results obtained. After the trial trip the steamer proceeded to the White Sea, under the command of Capt. Luja. See also Launches.

Armstor.—On July 24th, the s.s. *Armstor* left the Hartlepool Harbour to undergo her official loaded trial trip in Hartlepool Bay. The vessel has been built by Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., to the order of Messrs. Furness, Withy & Co., Ltd., for R. H. Holman, Esq., London. The *Armstor* is 336 ft. in length, 47 ft. beam, with a depth of 24 ft. 10 in., of the single-deck type, with poop, bridge and topgallant forecastle, and takes Lloyd's 100A1 class. Cellular double bottom is fitted throughout and the fore and after peaks are available as trimming tanks. The steamer is constructed with deep frames and longitudinal stringers, giving clear holds, and is divided into six watertight compartments by means of five watertight bulkheads, whilst wood grain divisions are fitted in the holds in accordance with the latest Board of Trade requirements. There are extra large cargo hatches, six steam winches worked from multitubular donkey boiler. A powerful quick-warping steam windlass is fitted forward, steam-steering gear amidships, with hand-screw gear aft. The whole of the machinery worked most satisfactorily throughout, a speed of 10 knots, fully loaded, being easily maintained. Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, have supplied the main engines and boilers. The sizes of the cylinders are 23½ in., 36 in., 64 in. by 42 in. stroke, steam being supplied by two large single-ended boilers working at a pressure of 180 lbs. per square inch.

Nyland.—On July 26th, this steamer, which has been built by Messrs. Wm. Doxford & Sons, Limited, Pallion Yard, Sunderland, for Messrs. Axel, Broström & Son, Gothenburg, was taken on her official trial trip, when a mean speed of 11 knots was attained, and the vessel proceeded direct to Jarrow for a cargo of coals. She is a steamer of 5,400 tons d.w., and has been built under the Bureau Veritas Classification. This is the second turret steamer delivered this year by the builders, and they have in course of construction two others of the same type, 7,100 tons and 8,000 tons, respectively.

Victor Hugo.—On July 30th, the fine steel screw steamer *Victor Hugo*, built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyards, Middlesbrough-on-Tees, and constructed on their well-known Patent Cantilever Framed System, with topside water-ballast tanks, to the order of Messrs. Delmas Frères, of La Rochelle, proceeded to sea for her official trials. The trials passed off most successfully, after which the vessel returned to the Tees, whence she will sail on her maiden voyage to La Rochelle, under the command of Captain Eugene Yvon. The hull and engines have been constructed under the superintendence of Mr. A. Beaugeois of Barry Dock, and Mr. Feuillatre. A Cochran (Annan) donkey boiler, with patent seamless furnace has been supplied and fitted. See also Launches.

Rubio.—On July 31st, the first-class cargo steamer *Rubio*, built by Messrs. Robert Thomson & Sons Ltd., Southwick Yard, to the order of Messrs. The Orders and Handford Steamship Co., Ltd., Newport, Mon. (the fifth vessel they have built for the same owners), was taken out to sea on her official trial. The runs on the measured mile were most successful, the speed results exceeding expectations. Mr. J. Boddy, of Newport, who has superintended the building of the vessel, was present on behalf of the owners and expressed himself highly satisfied with the vessel and her machinery. A Cochran (Annan) donkey boiler, with patent seamless furnace, has been supplied and fitted. See also Launches.

British Sun.—On July 30th, the steamer *British Sun*, a three-deck vessel for carrying petroleum in bulk, which has been built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, for the British Sun Co., Ltd., of Tower Buildings, Liverpool, was taken out to sea for her trial trip. On the trial trip she attained a speed of over 11½ knots. See also Launches in issue of August.

Polvarth.—On August 4th, the new steamer *Polvarth*, built by the Sunderland Shipbuilding Co., Ltd., ran her official trial trip. The machinery has been supplied by the North-Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 23½ in., 30 in. and 64 in. by 42 in. stroke, with two large boilers, which worked to the satisfaction of all concerned. Mr. Jos. Rose, the owners' superintendent, under whose supervision the vessel has been built, was present. The trial was in every way most satisfactory, a mean speed of 11½ knots being obtained. See also Launches.

BOARD OF TRADE EXAMINATIONS.

Extra First Class.

1909			
Aug	6th—Beatty, M B	.. ..	Ex 1C Barrow
,,	6th—Brackenbury, A L	..	Ex 1C Glasgow
,,	6th—Brown, P T	.. ..	Ex 1C Belfast
,,	6th—Bruce, F T.	.. ..	Ex 1C N Shields
,,	6th—Dudgeon, S	.. ..	Ex 1C Sunderl'd
,,	6th—Ewing, A	.. ..	Ex 1C N Shields
,,	8th—Forrest, J	.. ..	Ex 1C N Shields
,,	6th—Gidley, A H	.. ..	Ex 1C Hull
,,	6th—Machean, C S	.. ..	Ex 1C Glasgow
,,	6th—Mair, T W	.. ..	Ex 1C Glasgow
,,	6th—Mennie, W L	.. ..	Ex 1C N Shields
,,	6th—Potts, J	.. ..	Ex 1C W.Hart'l
,,	6th—Vie, E.	.. .. .	Ex 1C W Hart'l
,,	6th—Watson W.	.. ..	Ex 1C Hull
,,	6th—Wilson, A	..	Ex 1C Sunder'ld

NOTE—1C denotes First Class, 2C Second Class

July 16th, 1909.

Asquith, R .... 2C Liverpool
Aubrey, S .... 2C London
Bargh, C E .. 2C Greenock
Bell, W R .... 2C London
Bowden, J K 2C Greenock
Bowman, T A 1C S Shields
Crookshanks, P 2C Greenock
Dickinson, A .. 2C S Shields
Evans, W P .. 1C London
Field, T. D .. 1C Hull
Forrest, W .... 2C London
Forrester, W G 1C London
Forsyth, J .... 2C Greenock
Gathergood, S 2C London
Goffin, F W C 1C Hull
Gray, H ...... 1C Liverpool
Grubb, G. H .. 1C Hull
Heasley, M E 2C Liverpool
Higgins, V. C 2C Liverpool
Humphreys, T V 2C Dublin
Johnstone, G H 2C Greenock
Kerr, A .... 1C London
Little, W .... 2C Liverpool
Macintyre, R C 2C Greenock
Muir, W. B .. 2C S Shields
Murray, J D .. 1C Greenock
Payne, R .. 2C S.Shields
Pickering, R H 1C S Shields
Reay, T A .... 2C S Shields
Robinson, J M 2C Dublin
Sim, G G G 2C London
Slater, C. W L 2C S Shields
Smailes, E .... 1C Hull
Stewart, T .... 2C Greenock
Swedberg, C E 2C S Shields
Taylor, W .... 2C Liverpool
Thompson, C 1C Liverpool
Tidman, A R 1C Hull
Watson, S A .. 1C S Shields
Weaver, J F .. 2C Hull
Wilson, J .... 2C Greenock
Wilson, R .... 2C London
Wilson, S A .. 1C S Shields
Wright, A T .. 1C Liverpool

July 23rd

Adam, J J ... 2C South'ton
Alexander, J F 2C South'ton
Andrew, J J .. 2C South'ton
Black A M .. 2C Glasgow
Brierton, W. .. 2C Liverpool
Brown, C J. .. 2C London
Bunn, T W .. 1C South'ton
Coupar, D .... 2C Glasgow
Craig R G ... 2C W Hart'l
Cranston, J C.M 1C Leith
Curry, G. .... 2C N.Shields
Dishington, J G 2C Glasgow
Donaghy, W S. 1C W Hart'l
Findlay, J K .. 2C Glasgow
Frerland, J F 1C Liverpool
Galbraith, F .. 2C Glasgow
Gillard, S K .. 2C Cardiff
Greig, G ...... 2C Leith
Grundy, R J .. 2C South'ton
Hardacre, G C 2C South'ton
Harrington, L. 2C N Shields
Harvie, W .... 2C Leith
Higgins, A T 2C Cardiff
Hinkesman, J P 2C Cardiff
Hubbard, T H. 1C South'ton
Hunter, J .... 2C Glasgow
Houston, W H 2C Cardiff
Jones A H .. 2C Cardiff
Jones, D M 2C Cardiff
Lander, G J .. 1C Plymouth
Lewis, C S .. 2C Glasgow
Lloyd, G .... 2C Liverpool
Loveless, L S 2C Cardiff
Maciver, D K 1C Liverpool
McLarty, R B 2C Barrow
Miebach A .. 1C Leith
Mouat, J .... 2C Liverpool
O'Halloran, H S 2C Glasgow
Pearson, A R 2C London
Pike, E J. .... 1C South'ton
Rankin, E. G .. 2C Cardiff
Ray, D. R .... 2C London
Reavley, A E 2C W Hart'l
Rodaway, G .. 1C Cardiff
Smellie, A .... 1C Leith
Smith, J ...... 2C Leith
Sneesley, D H 2C London
Taylor, F .... 2C W Hart'l
Tinkler, J. .... 2C W Hart'l
Tweedie, N E L. 1C Glasgow
Walkinshaw, W. 1C Barrow
Webster, G .. 2C Liverpool
Whitewright, E. 2C Glasgow
Williams, F A 2C W Hart'l
Williams, G .. 1C Cardiff
Wilson, F V .. 1C South'ton
Wilson, H G... 1C W Hart'l
Young, C T .. 2C Leith

July 30th

Armstrong, T C. 2C London
Arnott, A .... 1C London
Billson, L. .... 2C N Shields
Blair, P ...... 2C London
Bowler, T G .. 1C Liverpool
Brooking, E. E 2C London
Cameron, J 2C Aberdeen
Cook, W S .. 1C N.Shields
Curry, F J .. 2C Sunderl'd
Dean, K. R. .. 2C Aberdeen
Edwards, G .. 1C Liverpool
Egdell, J W .. 2C N Shields
Fleming, F E. 1C Liverpool
Flett, J. R .... 1C Aberdeen
Gamble, W .. 2C Greenock
Goelnicht, L E 1C Greenock
Habgood, R 1C Sunderl'd
Hollingum, H J 2C London
Houghton, A J 2C Hull
Hume, J. S .. 2C N Shields
Jefferies, W .. 2C London
Laxton, H .... 2C Hull
Mitchell, J W 2C N Shields
Mossman, E H. 2C Liverpool
Nelson, W J .. 2C Liverpool
Norris, E L 2C London
Palmer, R P 1C Aberdeen
Parker, W W 2C N.Shields
Parton, B A. .. 2C Hull
Paterson, T. G 1C Liverpool
Peazer, J O. .. 2C London
Posgate, P .... 1C London
Robertson, J .. 1C Greenock
Rule, T ...... 2C Liverpool
Stores, A .... 1C N.Shields
Wilkins, R H 2C Bristol
Young, D. A .. 1C Bristol

August 6th.

Adair, E. ...... 1C Glasgow
Aitken, H C. .. 2C Leith
Arthur, R B ... 2C N.Shields
Balfour, A. K. 2C Leith
Barlow, G .... 1C N.Shields
Beggs, J ...... 2C South'ton
Bradford, J F 2C Glasgow
Calver, A E .. 1C South'ton
Caton, E .... 2C Leith
Davey, W. H 2C London
Donaldson, G 2C N Shields
Duncan, A .... 1C Glasgow
Ford, A ...... 2C N.Shields
Gifford, A S .. 2C Leith
Halpin, J .... 1C Liverpool
Johnston, W .. 1C Glasgow
Kidney, R. .... 2C Leith
McDougall, R F 1C N.Shields
McIntyre, J S 1C Glasgow
Mackay, R G 2C London
Mackenzie, J B 1C Belfast
Maher, J P J 1C London
Marat, J H .. 1C N.Shields
Miller, J ...... 2C London
Mitton, G H .. 2C Liverpool
Morris, W .... 2C London
Osborn, J. H .. 2C London
Phillips, S H 2C London
Pratt, H ...... 2C N.Shields
Redding, J..... 2C N Shields
Reid, A ...... 1C Liverpool
Roy, L. .. .. 1C South'ton
Scott, R C .. 1C London
Scovell, R W 2C South'ton
Sharp, A ...... 2C Leith
Soulsby, J D... 2C Liverpool
Stephenson, F H 2C Liverpool
Todd, C ...... 2C Belfast
Valland, F C O 2C London
Young, T P. .. 1C London

August 13th

Allen, J H .. 2C N.Shields
Barber, J. .... 2C N Shields
Bristow, H W 2C Hull
Brodie, H F .. 2C Greenock
Brown, B .... 1C Liverpool
Campbell, R S 1C N Shields
Campbell, W J 2C Liverpool
Colley, H J .. 1C London
Cooper, C S .. 1C N Shields
Coulbeck, W B 1C Hull
Hewitt, W W. 2C London
Hirchman, T .. 1C Liverpool
Jenkinson, W E 2C N.Shields
Jones, H. C .. 1C Liverpool
Jones, R M. .. 2C Liverpool
Little, J ...... 1C Greenock
Main, J C. .... 1C Hull
Monkhouse, T 1C N Shields
Needham, J H 1C Liverpool
Northcote, E S 2C London
Oakley, T V .. 1C Liverpool
Pullen, F .... 2C London
Roberts, R .... 1C Liverpool
Staunton, J J P 1C Liverpool
Wallace, W M 2C Greenock
Wallis, E W .. 2C Greenock
Ward, O A .. 2C Dundee
Youds, W .... 2C Liverpool

The Marine Engineer

And Naval Architect.

LONDON, OCTOBER 1st, 1909.

THE ROYAL INDIAN MARINE

THE regulations now being issued by the India Office for engineer appointments in the Royal Indian Marine are well worthy of the attention of young marine engineers between the ages of 21 and 25 years, who hold Chief or Second Engineer Board of Trade certificates. In past years the terms offered have not been sufficiently adequate to meet the requirements of the service, and the wisdom of reconsidering the whole question having become manifest to the authorities, the result has been a considerable improvement in the conditions of service. The terms are reasonable, and the prospects on the whole are good, as may be judged from the details of the regulations, a copy of which may be obtained on application to the Director General, and a perusal of which may be commended to the consideration of those to whom the regulations appeal. The rates of pay for Chief Engineers, Engineers and Assistant Engineers are consistent with the service in eastern waters. There are family pension regulations in connection with the service which every officer has to subscribe to. The leave privileges are liberal, being on the basis of about two months per year of service, but such leave may be extended in continuity over longer periods by accumulation, according to circumstances, the details of which are defined. The rates of pay during privileged leave are also good, being based on a graduated scale of reduction from full pay, and on a basis which reveals in its details a considerate thought which deserves appreciation and imitation. The leave pay, when drawn elsewhere than in India, is reckoned on the basis of 1s. 6d. per rupee. In addition to the rates of pay due to position and length of service, allowances are given to engineers according to the special service when in commission. There are several shore appointments in India which are usually reserved for engineer officers in the Service. These are enumerated in the regulations with the details as to office and salary. In connection with the promotions there were one or two points which appeared to be not altogether free from objection in the clauses, and we can conceive cases which might savour of favouritism rather than of merit and fitness, but these have been modified and no doubt wisdom and honesty, with that considerateness which appears to be exercised in the regulations otherwise, will be given full sway in dealing with cases as they arise. Retirement is compulsory when the age limit is reached, on a pension fixed on a graduated scale of grade and service. In the event of a shorter service than that prescribed for full pension, allowances are made to meet contingencies, such as illness or accident. The periods of service are reckoned to include privileged leave. While on the subject, as a matter of comparison it may not be amiss to call the attention of the Trinity House authorities to the terms and conditions of service ruling in the steamers under their jurisdiction. The disproportion is very great, even making liberal allowance for the different circumstances under which the Indian Marine Service engineers, and those of the Trinity House have to carry on their respective duties. To compensate the former for the lengthened period of service in eastern waters, the leave grants and conditions are good, added to which there are several appointments open exclusively to them on shore in India, while the pension scheme appears to be a very liberal one. The duties, as well as the responsibilities of engineers have been so multiplied and increased during recent years that it has been recognised that a superior education and training are necessary; engineers have therefore braced themselves to meet the new order of things and have creditably done so. This has undoubtedly secured the attention of shipowners, and is securing it more and more as the advantage of having skilful and attentive men in charge of machinery is seen and acknowledged. There is wisdom in this.

THE NEW AMERICAN ROUTE.

IT is an interesting fact, in view of the new arrangements which were recently inaugurated by the joint action of the Great Western Railway Company and the Cunard Company, that the possibilities of Fishguard as a harbour were pointed out by Brunel, the celebrated engineer, more than a hundred years ago. One cannot too highly appreciate the resolute manner in which the Railway Company have handled the important undertaking by which the difficulties involved in creating a seaport at a place where high cliffs existed, which came sheer down to the water's edge, were overcome. There is no doubt that it was the existence of these difficulties that was responsible for the choice of Milford Haven as the western port of this railway. We think the Fishguard district is to be congratulated on the fact that the Cunard Company have chosen this port of call for their largest Atlantic liners, as there is little doubt that this important departure should have a marked effect in the development of the port and its surroundings. The reasons for the selection of Fishguard as a port of call are not far to seek, seeing that the distance to New York is only 2,902 miles, being less by 55 miles than Plymouth, by 113 miles than Liverpool, by 175 miles than Southampton, and by 51 miles than Holyhead; the harbour is a good one, having 42 feet of water at low tide, the dangers to navigation are

few, and, what is very important for express passenger traffic, little risk of encountering fog. The inauguration of the new route was carried out by the *Mauretania*, which, leaving New York on Wednesday afternoon, August 25th, accomplished a voyage of 2,807 miles in 4 days 14 hours 7 minutes, reaching Queenstown at 7-27 Monday morning. Leaving Queenstown, she reached Fishguard and anchored at 1-20 p.m., delivered about 1,000 bags of letters which were transferred to the mail train and left Fishguard at 2-7 p.m., arriving at Paddington, after a run of 262 miles, at 6-41 p.m. The first passenger left the ship at 1-39 p.m., and, after disembarking 229 passengers with their baggage, the ship weighed anchor and left as the tenders made for the shore. The passengers left by the Cunard ocean express at 2-52 p.m. and arrived at Paddington at 7-29 p.m. It will be thus seen that mails taken on board on Wednesday were received in London on the following Monday evening. As a comparison we may point out that the German liner which left New York twenty-four hours earlier than the *Mauretania* delivered her passengers so that they only reached London seven hours earlier, which is seventeen hours to the credit of the *Mauretania* and the new route. It will, of course, be recognised that no benefit is derived by passengers for the north, who naturally leave the ship at Queenstown or go on to Liverpool; but experience has shown that the bulk of the traffic is relative to London and the Continent, hence the necessity of catering for the convenience of the greatest number of passengers. It is by such co-operation as is exemplified by the two companies in question that the taste for travelling on British liners to and from America will be maintained and the prestige of our mercantile marine upheld, in spite of the strenuous efforts of our competitors in their bid for custom. The amount of money sunk by the Railway Company in the development of Fishguard Harbour has been considerable, but there is no doubt the expenditure has been judiciously made and will in time bring in a rich harvest to the Company by increasing their traffic returns.

We give a view of Fishguard Harbour with the *Mauretania* at anchor.

Royal Naval Reserve.—It has been announced that long service decorations and medals in the Royal Naval Reserve will, in future, be awarded to all retired officers and men who fulfil the other conditions of the award, instead of being restricted to the men on active service

The Institute of Metals.—The autumn meeting of the Institute of Metals is to be held at Manchester on October 14th and 15th, and it is expected that the following papers will be presented :—" The constitution and properties of the Ternary Alloys Aluminium-Copper-Tin," by Mr. J. H. Andrew and Mr. C. A. Edwards ; " The surface appearance of solders," by Mr. C. O. Bannister and Mr. H. J. Tabor ; " The technical assay of zinc," by Mr. H. W. Greenwood ; " Notes on the production of pure spelter," by Mr. J. S. Glen Primrose ; " Some causes of the corrosion of copper and brass," by Mr. E. L. Rhead ; " The elastic breakdown of ductile materials," by Professor C. A. Smith ; and " The copper-zinc alloys—a study of volume changes during solidification," by Professor T. Turner and Mr. M. T. Murray.

The *Mauretania* outside Fishguard Harbour.

WATER-TIGHT BULKHEADS IN MODERN STEEL VESSELS.

It is very seldom the case at the present day that a designer of modern ships, or a critic of modern practice, is compelled to ask for an increase of scantling in any of the principal parts of the structure. Generally speaking, the very opposite is the case, and the energies of the designer are directed to obtaining as large reductions as he possibly can. In an article appearing in this journal last month, it was proposed to dispense with fitting intercostal side stringers Proposals are constantly being made, with a more or less show of reason, to reduce the number of floors and girders in the double bottom, to reduce shell plating, to reduce frames and increase their spacing. We do not hear the faintest whisper of a demand for *more* material at any part, and yet, without doubt, there are some parts of a ship's structure which are not outside the necessity for increased strength, and water-tight bulkheads, in our opinion, are a case in point, and first of all as regards the spacing and number of the bulkheads, the above remark is true. The water-tight sub-division of a ship has for its intention the safety of the vessel when a compartment is in full communication with the sea, in moderate weather. The most severe condition is that assumed when two compartments are simultaneously in communication with the sea, thus involving an injury to the ship in the vicinity of a bulkhead. We do find in some high-class passenger vessels an attempt made, by fitting an adequate number of bulkheads and by adopting an efficient spacing, to attain safety under the latter conditions, but in many cases there is no such attempt made, and by reason of the exigencies of trade, or to suit the internal arrangements adopted, the bulkheads which are fitted are not disposed on principle of sound design. In cargo vessels there is an increasing tendency, especially in the timber-carrying trade, to do away with all bulkheads except those absolutely necessary, *viz.*, those at the ends of the machinery space, and at the fore and after peaks. Indeed, we remember one case of a large vessel with machinery fitted aft, where, forward of the boiler-room bulkhead, there was a clear hold of nearly 300 ft. in length. It is needless to speculate upon what happens to a vessel such as that in the event of substantial injury below the load line. The design of purely cargo vessels, of course, is governed, in the majority of cases, by certain rigid conditions of trade, but in the design of large passenger steamers more care should be expended on the problems connected with the efficient water-tight sub-division of the vessel.

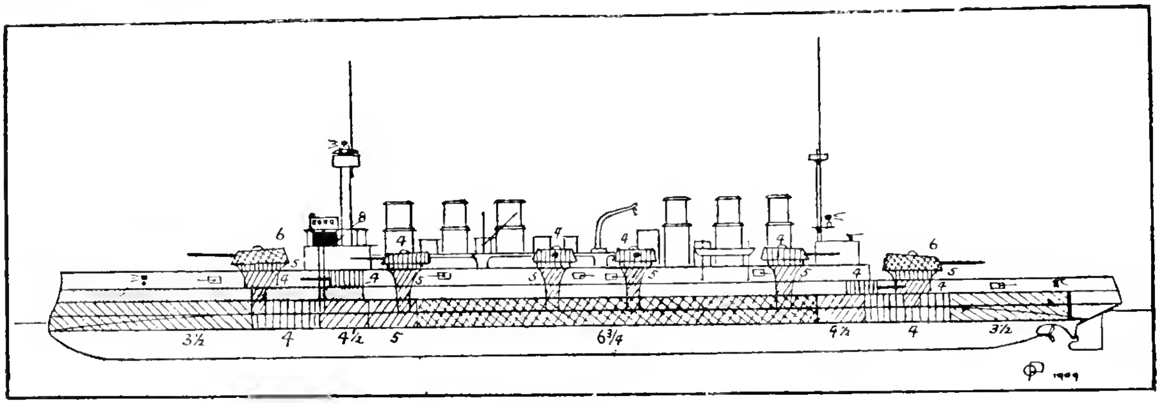
If it is true that in many cases more bulkheads should be fitted, it is also true that in a still greater number of cases the scantlings of the bulkheads should be increased. If a bulkhead is fitted in a vessel merely as a cargo division, then there is nothing more to be said; but if it is intended that the bulkhead shall localize damage when a compartment is full of water, then it should be constructed accordingly. The old fashion of stiffening a bulkhead was to fit a series of webs and horizontal girders, associated with stiffeners of a smaller size spaced from 24 in. to 30 in. apart. These relatively small stiffeners supported the bulkhead plating and transmitted the loads coming upon the latter to the webs and girders, which, in their turn, communicated them to the solid supports at the decks, tank top and side ofs vessel. This system, while presenting certain objectionable features, yet had this to commend it, that the webs and girders developed the efficiency of the bulkhead and increased its stiffness *as a whole*. In 1890, however, there was appointed a Commission to report upon (among other matters) the construction and fitting of water-tight bulkheads. That Commission gave the *imprimatur* of its approval to a system of stiffening, which has since been largely adopted in merchant vessels. The system is much more simple and less expensive than the one referred to above, and these qualities have, no doubt, contributed much to its general adoption. The system consists of the fitting of vertical stiffening bars between the deck and tank top or floor, no girders or webs being employed. The stiffeners vary in size according to their length and according to the depth of the vessel, and they are connected to the tank top plating by brackets. This method of stiffening bulkheads is reasonably sound in principle, but from its very nature, to secure the same strength as in the old system, more material should be employed. It will be found, however, that in the great majority of cases this is not so.

However, before dealing with that, we may ask the question—In designing a series of uniform bulkhead stiffeners (uniform of course, for practical reasons) what conditions should be assumed? Some would in every case take into account the support afforded by the presence of cargo on the other side. We believe, however, that if the structure is to be really a water-tight bulkhead, no weight should be assigned to such a consideration and the standard to be assumed is that the bulkhead is supporting a head of water equal in height to the load line. This is not an excessively high standard, since it is quite within the limits of probability, when it is considered that in actual time of trial, in a seaway, the forces acting on the bulkhead will be of an impulsive character, the actual magnitude of which no one can correctly calculate. Taking then this load, and working out the normal stresses on the stiffener at the centre of the vessel by the ordinary beam method (which may fairly safely be applied there) it will be found that the resultant stresses will be beyond what is considered a safe limit. Let it be remembered also, that the stiffeners are not connected to the deck, and where a connection is effected to the tank top it is usually by means of a small bracket riveted to the flexible tank top plating. This want of rigidity at the ends makes it difficult to determine a reasonable bending moment constant. Even assuming, however, that the presence of the bracket at the bottom quite fixes that end, the above statement will be found to be true. When a deep water ballast tank is fitted in a vessel, the stiffening is of a most substantial nature, and yet a great deal of trouble is in many cases experienced with these tanks after a few voyages. While it is true that there is a vast deal of difference between a deep tank bulkhead and an ordinary water-tight bulkhead, yet, when it is considered that the one has to do in an emergency what the other has to do every other voyage, it will be felt that there ought not to exist so serious a disproportion between the respective stiffening. It is considered, therefore, that there is a distinct case for an increase in the strength of bulkhead stiffeners (not plating), and this may be effected by not only increasing their scantlings, but by obtaining a more rigid connection at the top and bottom and by making bracket large enough to cover the adjacent floor.

An Interesting Auxiliary Motor Installation.—One of the most interesting auxiliary motor installations of the season has recently been completed by the Ailsa Craig Motor Co., of Strand-on-the-Green, Chiswick, London, W., on Mr. Longbottom's yacht *Rubicon*. The unique feature is that the couversion to auxiliary power was made without any structural alterations and while the vessel was afloat in Poole Harbour. The Ailsa Craig patent auxiliary motor device was used, and this installation is specially noteworthy, as the *Rubicon* is now the largest vessel afloat with this ingenious arrangement. The engine is placed on deck and by means of a cross shaft and gear drives the propeller shaft, which is supported on a spar slung over the side of the vessel. When not required the whole device is lifted inboard and stowed away on deck out of sight. The machinery is entirely cased in and special provision has been made to avoid soiling the decks. The motor serves a double purpose and is arranged to drive a dynamo which provides light for the whole ship and keeps a battery of accumulators charged to supply current when the engine is not working. The *Rubicon* is a ketch of 70 tons t.m., and the device gives her a speed of 5-6 knots under power alone. After the installation was completed she went for a three weeks' cruise to Falmouth and district for the purpose of thoroughly testing the device, and although primarily intended for use in calms only, it was used in quite rough weather with perfectly satisfactory results. Immediately after her return to Poole the electric light equipment was installed, and she left for a cruise in Holland, whence Lord Ardee's cutter *Patience*, also fitted with the Ailsa Craig motor device, has just returned. It speaks well for the wonderfully smooth running qualities of the Ailsa Craig engines when one remembers that the motor is installed right over the saloon, and yet, when running at full speed, there is so little noise that conversation can be carried on without raising the voice. The absence of vibration is very marked also, and it was tried by the test of placing two wine glasses in close proximity on the saloon table, when there was no clinking together.

FRENCH ARMOURED CRUISER "ERNEST RENAN."

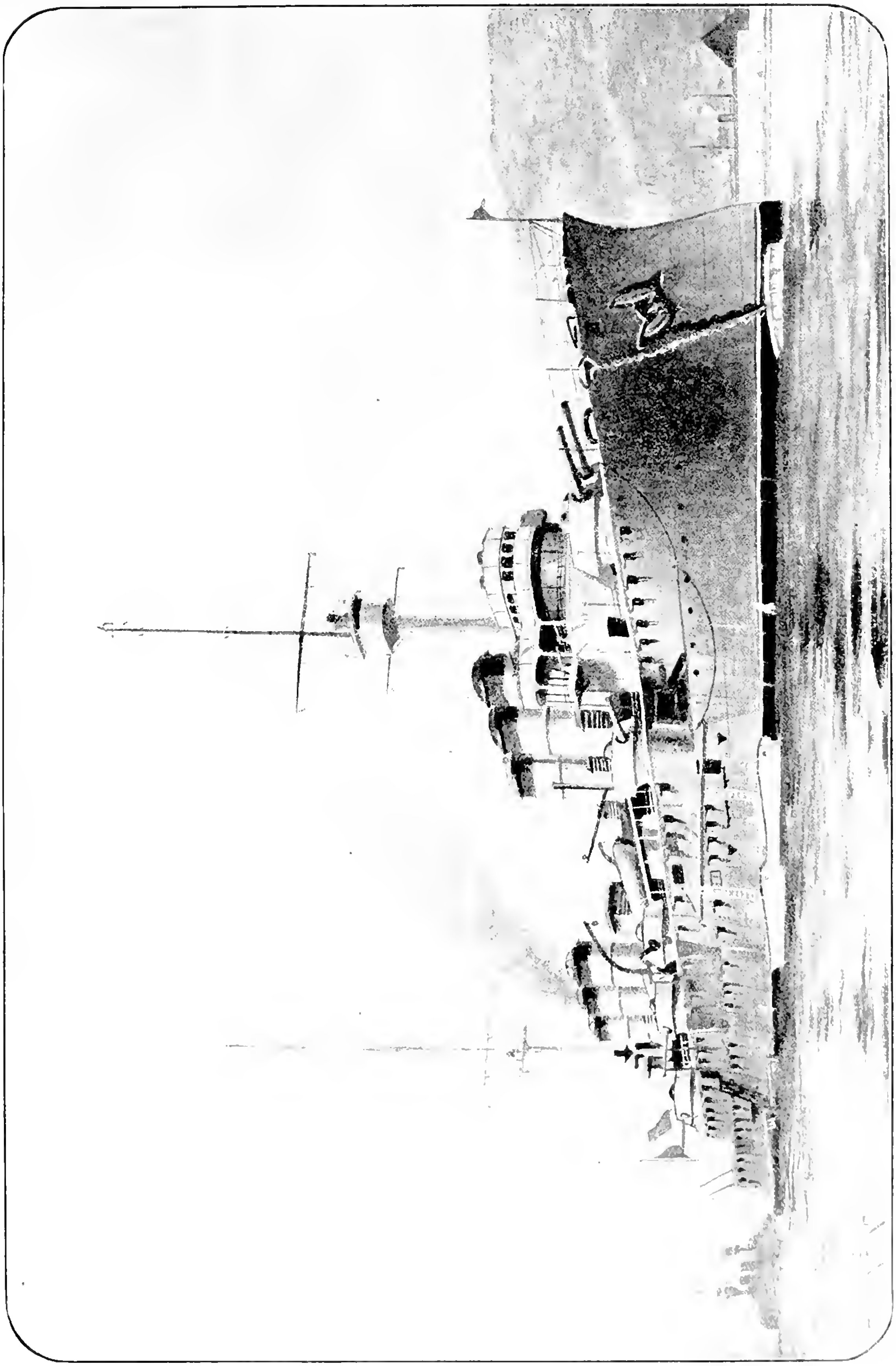
LAID down at St. Nazaire in October, 1903, the *Ernest Renan*, a contemporary of our *Black Prince* class, has only recently entered into service. Her completion was retarded owing to her drawings being frequently altered from one cause or another. She was originally intended to be a sister to the well-known *Gambetta*, with a displacement of 12,416 tons, carrying four 7·6″ guns in double turrets fore and aft, and sixteen 6·4″ in six double turrets on the topsides and four casemates, while, with 27,500 i.h.p., her speed was to have been 22 knots. Under M. Pelletan's administration, however, construction was suspended and the ship completely re-designed in order to secure an extra knot or two more speed, the horse-power being increased to 37,000! Consequently in 1904, when details of the modified *Renan* became known, she was given as carrying two 9·4″ guns in single fore and aft turrets and twelve 6·4″ in six double topside turrets, her dimensions being: Length 515 ft., beam 72 ft. and draught 27 ft. Incidentally she was only to have had four funnels. This armament was, however, again altered, and she was given four 7·6″ instead of the two 9·4″, and the 6·4″ guns were re-distributed, eight being carried in single turrets and four in casemates. The belt also was increased from 6″ to 6¾″ amidships and reduced from 4″ to 3″ at the bow and stern. In 1906 the secondary battery was increased to sixteen 6·4″, twelve of which were paired off in twin turrets and the remainder in casemates. A suggestion was put forward to replace the paired guns by single 7·6″ pieces and bring the whole armament down to fourteen 7·6″ guns. Finally, when it was found impracticable to mount the sixteen guns a reversion was made to the former number, and the armament was definitely fixed at four 7·6″ and twelve 6·4″. During these various vicissitudes the dimensions of the ship were altered again, the beam being reduced from 72 ft. to 70¼ ft., in order to secure a higher speed than 23 knots. Needless to say, her construction in these transitionary stages was slow; she was launched in March, 1906, and sent off on her preliminary testing runs during 1908. On August 21st she made a twenty-four hours' trial, developing 22,560 h.p. and registering a mean speed of 21·3 knots. These figures were greatly improved upon on September 5th, when she made 24·8 knots during a five hours' run at 37,000 h.p. (this was her designed power to register 23 knots). Troubles were then developed in the engine-room,



Ernest Renan Plan

COMPARATIVE TABLE

	Renan.	*Gambetta*	*Drake.*	*Black Prince*	*Washington.*	
Nation	French	French	British	British	U.S.A.	
Laid down	1903	1901	1899	1903	1903	
Displacement (tons)	13,644	12,416	14,000	13,550	14,500	
Length (feet)	515	476	500	480	502	
Beam	70¼	71	71	73½	73	
Draught	27	26½	26	27½	26½	
Main Armament	4—7·6″ (45)	4—7·6″ (45)	2—9·2″ (45)	6—9·2″ (50)	4—10″ (40)	calibres
Secondary	12—6·4″ (50)	16—6·4″ (45)	16—6″ (45)	10—6″ (50)	16—6″ (50)	calibres
Tertiary	18 9-pounders	24 3-pounders	14 12-pounders	22 3-pounders	23 14-pounders 12 3-pounders	
Torpedo Tubes	2+3 submerged	2+3 submerged	2	3 submerged	4 submerged	
I.H.P.	37,000	27,500	30,000	23,500	23,000	
Boilers	Niclausse	Belleville	Belleville	Babcock	Babcock	
Designed Speed	23	22	23	22⅓	22	
Highest	25·5	23	25·1	22·5	22·4	
Coal (tons)	1350—2300	1320—2100	1200—2500	1000—2000	900—2000	
Belt—Fore, amidships, aft	3⅓—6¾—3⅓″	3—6¼—3″	3—6—3″	4—6—3″	3—5—3″	
Big Guns	6″	8″	5″	7″	9—5″	
Secondary Guns	4″	5½″	6″	6″	5″	
Deck	2½″	2¼″	3″—2″	3—4″	2″	



French Armoured Cruiser "Ernest Renan."

and it was not until March 13th, 1909, that she really improved upon these figures, when, with 37,100 h.p., she touched a maximum of 25 knots on a ten hours' run. During June she developed 37,500 h.p. on her final acceptance runs, and put up a record speed for French cruisers of 25·5 knots, for which her builders are to be congratulated.

Hence for the present the *Renan* is the fastest and biggest unit of our neighbour's cruiser fleet. The much-delayed *Edgard Quinet* is still incomplete, but, being some 400 tons heavier and 6" greater in the beam, it is doubtful whether she will wrest the speed laurels from the *Renan*.

Regarded as a modern fighting ship, little can be said for the type. At the time of her inception she was the most powerful Continental cruiser, but since then Germany has passed the two *Gneisenaus* into service, Russia has the *Rurik*, Italy the *Pisa* class, and we have completed four *Natals*, three *Shannons* and three *Invincibles*; so that already the *Renan* is obsolescent, especially now that the German *Blucher* and *Von der Tann* are nearing the finishing stages. As may be seen from the plan herewith, she possesses the complete w.l. belt, which has always been a characteristic French feature, but the mushroom-shaped turret bases—the worst feature of all the ships of her period—make her peculiarly vulnerable to shell fire. In her artillery, however, she obtains a decided advantage over ships carrying similar armaments. The 1902 model guns are particularly effective, so much so that the *Renan's* 7·6" are practically equal in penetration to the 9·2" of the *Drake's*, while the 6·4" is infinitely better than our contemporary 6", the penetration being identical (on the proving ground) with that of the 7·5" which our *Devonshire* class carry. To carry the comparisons still further, the 7·6" French gun is but little inferior to the huge 67-ton 13·5" piece carried on the *Royal Sovereign*, and the 6·4" can get through just as much armour as the old 10" gun, which formed the main armament of the *Barfleur* and *Centurion!*

The *Renan* is the second six-funneller in the French Navy, the third other ship with this distinction being the old *Italia* of the Italian fleet. Consequently she presents rather a large target, and it is certain that her speed would greatly suffer when her funnels became much knocked about in action. The forward mast is considerably lighter than has been previously stepped into big French cruisers, and later ships will have even this moderate top-weight reduced.

In the table on page 82 she is compared with similar ships of her date. The *Gambetta* was originally a sister ship, and the sacrifices made to attain the increased speed can be easily traced. On the whole she is superior to the *Drake* and, on paper, inferior to the *Black Prince* and *Washington*.

The Port of Dover. Dover is bestirring itself in every direction. A new marine station is to be built on the Admiralty Pier at a cost of £1,000,000, and it is said that it will be as large as Charing Cross Station is now. It will be readily understood for such a site what a character the work will have. As to the mail boats running from here for the Ostend service the Belgian Government has ordered two new turbine steamers to be ready next year, and the railway company is fitting all its boats with wireless apparatus, the *Empress* being the first so supplied.

THE EXTENDED USES OF ELECTRICITY ON BOARD SHIP.*

THE application of electricity on board ship for driving auxiliary machinery has made rapid headway of late years. The time has now arrived for engineers to consider the most economical means of applying electric power for ship work, as at present there is great scope for such. My proposal is to drive all the auxiliary machinery by the use of electric motors, which will include all cargo winches and hoists, capstans and ventilating machinery, etc., and also to use electricity for the heating of cabins and passages and for cooking. In the engine department to drive all pumping, refrigerating, lifting machinery and fans by the use of electric motors, and, of course, to use electricity for lighting the ship throughout.

It is rather difficult to get at exact figures, but I have come to the conclusion that the efficiency of the steam plant is about 25 per cent. Owing to the great length of present-day ships and the increase of auxiliary machinery, the steam has greater distances to travel, with great loss by radiation. The back pressure of the exhaust steam travelling to the winch condenser is very considerable. Several ships have no winch condenser and the exhaust from the winches is led up the waste steam-pipe, the water being carried to a tank, thence pumped out to the donkey boiler. I suppose there is not more than 10 to 20 per cent. of the water returned to the boiler in these cases. I have asked several shipowners and superintendents what it costs to run the machinery to discharge or load the ship per ton of cargo, and I gathered from their replies that there is great diversity of opinion on this subject. In many cases the main boilers are used for loading or discharging cargo, the donkey boiler seldom being used for this purpose at all, as when all the winches were working, steam could not be maintained. I have thus come to the conclusion that many ship designers and engineers were a long way out in their estimate of the power required for driving the winches properly, due to the fact that the great losses to be met with in working the auxiliary machinery were not properly recognised and allowed for.

A suction gas installation is one of the cheapest and most efficient forms of power known at the present day, suitable for commercial purposes. I am also convinced that it is admirably suitable for auxiliary purposes on board ship, used in conjunction with electricity. I will not say that it would be cheaper on the first cost, horse power for horse power, but for equal powers the working of the plant would show a very considerable reduction in working costs, and it would soon pay for any increased capital outlay. In the system I propose the greater part of the present losses by steam would be obviated. A moderate estimate of the efficiency of a plant, such as I propose to describe, is 80 per cent.; this figure, compared with the efficiency figure for the steam plant before mentioned as a maximum of 25 per cent., gives a difference in favour of the suction-gas-electrical plant of no less than 55 per cent. In a large ship the monetary saving, therefore, would be very considerable, and it is this side of the question which appeals to shipowners and is causing them to be keenly alive to anything bearing on the question. In my last paper I was asked what objection I had to the continuous current motor which is at present largely used for ship's work; my answer to this is that it is my object to eliminate all rubbed surfaces, such as brush and commutators, from the exposed motors, these being a source of trouble and expense. This can only be got over by the use of alternating current for driving the motors, as the induction motor has no commutator proper, and possesses many advantages over the continuous current motor, chiefly in simplicity and freedom from breakdown. I do not wish to unduly depreciate the continuous current motor, which has done good service in the past, but owing to the progress made in alternating current motors it has been surpassed by the alternating motor for a great many purposes. I propose to deal with the subject under three heads, *viz.*, the Producer, the Gas-engine and the Alternator, and briefly

*Read by Mr. John McLaren (Member of Council), to the Institute of Marine Engineers on Saturday, September 4, in the Congress Hall, Imperial Exhibition, Shepherd's Bush, W. Chairman, Sir F. Flannery, Bart. (Past President).

describe the most suitable form of each for the purpose of installing on board ship for driving the auxiliary machinery. I believe that in the near future the introduction of the suction gas plant will cause a great revolution in the ideas of sea-going engineers. I do not propose to give my reasons for this statement in detail, but would say that its extreme simplicity, its great economy, both as regards working costs and space occupied, are sufficient to recommend it. At the present time the suction gas plant and engine has an assured position on shore, and the time must come when its advantages will be equally recognised for marine purposes. The size of plant required for driving the auxiliaries on board ship, of course, depends upon the size of the ship and the number of machines required, but for the purpose of this paper I suggest a 300 H.P. unit. Suction gas is obtained by the oxygen of the air passing through the incandescent fuel, combining with the carbon of the fuel to form carbon monoxide, the steam, which also passes in with the air, splits up and forms more monoxide and free hydrogen. A certain amount of marsh gas and carbon dioxide is formed, so that suction gas is composed of the combustible gases, carbon monoxide, hydrogen and marsh gas, with a certain amount of non-combustible gases, carbon dioxide and nitrogen.

PRODUCER. The gas generator is usually made of steel plates, to allow for expansion and contraction, lined with fire-clay bricks or other suitable material. The ashpit and fire-grate are preferably made of cast iron, which, although a little heavier, wears much better than a steel plate would do, and is more able to withstand corrosion. On top of the generator and embodied in the design is an arrangement for raising the steam required for making the gas; this steam is raised by the heat arising from the incandescent anthracite in the generator and is not under pressure. The gas from the generator passes down a special pipe which serves a double purpose, *viz.*, that of cooling the gas and heating the in-going charge of steam and air. The gas is then passed through coke scrubbers which are made in two parts; passing through the water seal of the scrubber the gas gives up the heavier particles of dust and tarry matter; when passing up through the scrubber the gas meets a descending spray of cold water which further cleans and cools the gas. This action is repeated in a second scrubber and then passes into the gas box from which the engine draws its supply of gas. The engine only takes the quantity of gas it requires. The gas producer can be placed in any convenient place, as the gas loses nothing by the distance it has to travel. The producer is easily kept clean, and is easily worked compared with a steam boiler. The average amount of attention required is due about every two to four hours. The only air entering the generator should be that passing through the proper channel. The approximate weight of the producer plant for 300 H.P. would be 19 tons, and the space occupied about 14 ft. by 10 ft. 6 in. by 16 ft.

GAS ENGINE. The type of gas engine I would suggest as most suitable for our purpose would be a vertical multiple cylinder, single-acting type, operating on the Otto or four-cycle principle. The cylinders should be arranged so that there is ample space for water cooling; the water jackets should have large ports so that any scale deposited by the salt water used for cooling purposes can be easily and quickly removed. The type of engine adopted should be such that none of the moving parts require water cooling. This is a point which I think is worth noting, because, if the moving parts were water-cooled and the circulation for some cause or other got stopped, these parts would speedily heat up and expand and give great trouble. With the cylinders and covers only water-cooled there would be no fear of trouble of this sort. The valve gear should be as simple as possible and so arranged that the parts can be easily got at. The mixture-regulating handles, starting valves, ignition timing, speed regulation, should be mounted together on the crank-case of the engine, so that all can be controlled by one man from the floor level. The engine would be started by compressed air through a special starting valve. The usual method of ignition for gas engines of this type and size is by high-tension electricity, but for marine purposes I think that low-tension magneto-ignition would be preferable, especially in view of the fact that the plant would be working in all temperatures. The speed of the engine should be about 200 R.P.M. to suit the alternator. A good governor should be fitted. The modern governor is very effective, this is one of the advantages of the gas engine. There are makers who will now guarantee their machines to act at 2 per cent. from full load to no load; 5 per cent. is quite a common thing. The whole system can be started up in thirty minutes from cold, and from fifteen minutes when standing by, which means under banked fires. A silencer would be fitted to the exhaust pipe.

THE ALTERNATOR. In my last paper on this subject I suggested that 2,000 volts might with advantage be used on large ships and transformed at the point of use to 250 volts for operating the machinery, in order to reduce the cost of the transmission cables. This voltage was rather objected to in the subsequent discussion, on account of possible danger; although, as I then stated, the system could be made absolutely fool-proof. However, in a moderate sized vessel I now suggest that alternating currents should be generated at 250 volts and carried direct to the machinery. The generator I suggest should be built upon the fly-wheel of the gas engine and generate three-phase currents at 250 volts at a periodicity, of, say, 50 cycles. Perhaps at this point it would not be out of place to give a simple and brief explanation of what is meant by the term "alternating current" and "periodicity," or, as it is more usually called, the "frequency." A current of electricity which passes through a complete cycle of changes of both magnitude and direction at regular intervals of time is called an alternating current. The time taken for a complete cycle of changes is called the "period," and the number of cycles or complete changes per second is called the "frequency." Alternating current is spoken of as "single-phase," "two-phase," or "three-phase." Single-phase is just a series of waves along a single circuit, first one way and then another. Two-phase is the description given to a generator in which the armature is wound in two sets of windings to produce two separate currents in two separate circuits, in one of which the wave will be at its maximum when the other is at zero. In a three-phase generator the armature has three distinct windings which generate three separate currents, the waves succeeding one another at regular intervals. By connecting the inner ends of these circuits together only three cables are needed to convey this current, but for our purpose I propose to bring out a fourth wire from this point, called the neutral wire.

The Armature of the generator should be of the stationary type with revolving field magnets built up on the rim of the gas-engine fly-wheel. A small direct current dynamo, called the "Exciter," from the fact that it supplies a small current for exciting the coils of the alternator field, should be coupled direct to the armature shaft. The exciting current is carried to the revolving field of the alternator by means of two small slip rings with metal brushes. It is worthy of note that this is the only electrical rubbing device on the alternator, and it is of such a simple nature that it could give hardly any trouble. The armature would be wound to give three-phase currents and would be star connected. In selecting the type of alternator, care should be taken to see that the wave form of the currents is sinusoidal; this would eliminate those heavy potential stresses which are often a source of danger to the windings and power circuits of alternators which have a peaked wave form. This danger is a very serious one in those machines generating high pressures. The generator should have a liberal factor of safety to enable it to deal with large overloads, should the necessity arise, without danger of breakdown. A suitable switchboard to control and distribute the current would be placed in some convenient position in the gas-engine room and divided into two distinct sections, one for the power circuits and one for the lighting circuits. The power section would be divided into panels for each power circuit, and from each panel would be led a three-core cable, suitably insulated and armoured, to supply current to each distributing centre. From this point smaller mains would be taken off to each alternating current motor in the group controlled from this centre.

SMALL MOTORS. For the smaller motors I propose to use the induction type commonly known as the "Squirrel cage" motor. This type of motor would have no commutator or collecting device of any kind, and would be switched straight on to the mains when starting. The armature, or, as we shall call it the "rotor," of this type of motor consists simply of a laminated iron core with a number of straight copper bars lying in slots; these bars are insulated along their length, but are connected together at each end by means

of a copper ring, thus giving the rotor the appearance of a squirrel cage. The field, or stator, is wound with three sets of coils with three separate currents flowing, the waves of which occur in succession as previously mentioned. Each current produces its own "lines of force," which rise and fall round the conductor just as the current does; thus the magnetism is strongest round one set of coils, then the next and so on in regular sequence. This produces what is known as a revolving field. These regular rising and falling lines of force cut the conductors on the rotor and induce a current to flow in them; these induced currents produce magnetism in the rotor, which, acting in the same manner as the direct current field and armature, force the rotor round with a powerful or torque twisting effort.

Heavy Motors.—For the more powerful motors, owing to the heavy rush of current required for starting purposes, it might perhaps be necessary to use a slightly different type of rotor wound somewhat similar to the stator winding, so that resistances could be inserted for starting purposes. The methods that are usually employed in use with polyphase alternating current power transmission (with current generated with constant periodicity), shows that it is necessary to employ induction motors fitted with slip-rings, or auto-transformers, either for getting speed regulation, or for reducing the voltage at starting, etc. It will thus be seen that although there is no doubt that motors so fitted are vastly superior to motors as now used with commutators, as in the continuous current method, necessitating the use of regulating resistances for speed, and introducing a source of loss of energy, although the series or shunt-wound direct current motor has all those valuable characteristics that are necessary for crane work, etc., such as high and efficient starting torque. There is no question about the fact that if it were possible to use the simple squirrel-cage induction motor, with polyphase alternating current, that we should have a most ideal condition of affairs, as this motor, consisting as it does of only two parts, the stator and the rotor, with no moving contacts whatever, is the most simple motor yet made. The main reason why this motor has not been more used is because of its natural and inherent faults: if these should be overcome, the field for this motor would be vastly extended, including its use on shipboard for driving machinery. This motor has not only simplicity, but is combined with great mechanical strength of structure; the absence of commutators is an immense advantage, and not an inconsiderable item when thinking out an electrical power transmission system on a ship—in this design of motor there is no sparking limit to allow for, as in continuous current motors, therefore it can stand the roughest of use, and it has the greatest of output per unit of weight as compared with a direct current machine, and without sacrifice of efficiency. It is a well-known fact that a squirrel-cage polyphase induction motor will run on a given load, quite cool, when compared with direct current motors of the same weight. This is partly due to the large section which can be given to the conductors, and also to the laminated character of the iron, which facilitates ventilation. Generally speaking, it is not too much to say that whilst continuous current motors and dynamos will always be a class of electrical machinery that requires more or less skilled attention, the polyphase motors and generators can practically be termed a piece of mechanical machinery, requiring no skilled and very little unskilled attention; consequently, the maintenance is reduced to a minimum, and, further, in the squirrel-cage motor, the main working current passes only through stationary windings, while in direct current machines the main working current has to pass through rubbing contacts, such as commutators, a well-known source of trouble.

A further valuable feature in connection with the squirrel-cage induction motor is the fact that, should the rotor by any outside means be driven above the synchronous speed of its revolving magnetic field, the rotor bar windings cut lines of magnetic force, and the machine immediately becomes an a-synchronous polyphase generator, and will return current to the supply mains. Should such a motor be driving a crane, on lowering a heavy load into the ship, not only will the load be steady, but a portion of the energy represented by the falling weight could thus be returned to the mains, and possibly utilized for supplying other motors, with a reduction of working cost. This motor has some defects which, up to quite recently, have debarred its general use especially on board ship. For driving cranes, winches, hydraulic pumps working against head, refrigerating and other machinery, great starting torque is necessary; the squirrel-cage induction motor has very little starting torque when supplied in the ordinary way, *i.e.*, with current that is at a constant periodicity and voltage. This is due to the fact that the time limit in the rotor is not quite in relation with that in the stator. The heavy current in the motor when standing, with the current turned on in the stator, does not allow the magnetic field in the rotor to rise and die down with the same rapidity as that in the stator, consequently there is not such a powerful couple between the stator and the rotor as when the rotor is running at, say, top speed, when the periodicity in the rotor is reduced to almost zero, the slip being about 2 to 4 per cent. then, but at starting the slip is of course 100 per cent. Therefore, before the simple squirrel-cage motor can be used satisfactorily for general purposes on ships, it is evident that some means must be found so that the periodicity of the supply current to the motor at starting can be reduced, and gradually brought up to that required for full speed. It is also important to have reliable means of speed variation for such motors as will be used for cargo work, that the speed of the motor can be varied with economy. The only way to vary the speed of the simple induction squirrel-cage motor is by varying the periodicity of the supply current to it, and up till now efficient means have not been available, and the general application of this motor is thus limited to driving machines that either require very little starting torque, or where no speed variation is required. There is a system of speed variation applied to induction motors without the use of slip-rings or auto-transformers, just put on the market by Mr. Durtnall, which may meet all the requirements which will be demanded, and by means of the generation of variable periodicity current, will overcome the defect of bad starting against load, and also will secure the variation of speed that will be required, and, as far as I can see, it is sound mechanically and electrically, while its simplicity will appeal to the progressive marine engineer.

The system is best explained by reference to the design of the plant for operating the machinery for a large dredger now being built, in which it is proposed to use as the prime-mover a 200 B.H.P. Diesel engine, running at 300 R.P.M., this to run at constant speed irrespective of the speed or direction of rotation of the squirrel-cage induction motors, which are to be direct coupled to the bucket chain, main winch, rotary pumps, ladder winch, revolving screen, and belt conveyer. These will be driven by three-phase current, at variable speed as desired, through special controllers situated at the motor, by which means reversing of the machine at any speed can take place. The voltage is to be 350 (between phases); the periodicity will be generated at 10, 20, 30, 40, 50 and 60 periods per second, or with 1,200, 2,400, 3,600, 4,800, 6,000 and 7,200 alternations per minute, which means that (with, say, 3 per cent. slip) the 8-pole motors that are to be used in this connection will run at either of the following speeds when connected with the above periodicity current through the controller—146, 290 437, 582, 730, and with a top speed of 874 R.P.M.

The generator in this instance will consist of six small machines, mechanically coupled together in line and on one base-plate. These will be driven at constant speed by the Diesel engine at 300 R.P.M.; they will consist of 4-pole machines, constructed as follows: the first machine will be a synchronous 3-phase alternating current generator; this will give the 10-period current, the field of which will be separately excited (either from the continuous current lighting circuit, or from a small exciter that can be driven by, and mounted on, the end of the prime-mover crankshaft); the other machines will be 5-transformer generators. The primary of the first transformer will be excited by means of the 10-period current, and this primary being mounted on the same shaft as the 10-period generator, and being of the same polarity, means that the periodicity of the current in the secondary of the transformer (which is a stator) is double that of the 3-phase generator, namely, 20. For this reason the revolving magnetic flux in the primary revolves once ahead of one mechanical turn of the prime-mover shaft, tappings from the stator secondary winding are taken off to provide the 20-period current. In the next transformer the opposite is provided, that is, the 20-period current is taken to the primary stator, and it is so connected that the magnetic flux revolves

in the opposite direction in the air-gap, that its mechanically driven secondary turns in; the consequence is, that, as the polarity of the machine is the same as the 20-period transformer, the periodicity in the revolving secondary is raised to 30 periods, for this reason, that for one mechanical turn of the secondary the magnetic flux in the stator primary turns twice in the opposite direction (which makes the relative speed of the magnetic poles or flux equal to a 12-pole machine driven at 300 R.P.M.). Tappings are taken by means of slip-rings from the windings of the revolving secondary to provide the thus 30-period current; this 30-period current also forms the exciting current for the mechanically driven primary of the third transformer, in which the magnetic flux revolves three times ahead of one mechanical turn of same. The result is that the periodicity in the stator secondary is raised to 40 periods, with tappings taken off, etc. This forms the exciting current for the stator primary of the fourth transformer, and is sent in such a direction that the magnetic flux in same revolves in the counter-direction to that of its mechanically driven secondary, the periodicity in which is raised to 50 periods because the magnetic flux revolves four times against one mechanical turn of the prime-mover shaft. Slip-rings are now provided to take off the consequent 50-period current. This current also forms the exciting current for the mechanically-driven primary of the final transformer, and is so connected that the magnetic flux revolves in the same direction as the mechanical rotation; the consequence is that the periodicity in the stator secondary of this transformer-generator is raised to 60 per second, because the magnetic flux revolves ahead of the mechanically driven primary five times per mechanical turn; tappings are therefore taken off the secondary winding to provide the 60-period current. The distribution of the electrical energy is to be carried out by means of bare copper bars, led to a trunk set of mains running the distance each side of the engine-room where the motors will work, where tappings are to be taken off by means of suitable cables to the controller, or periodicity selector, as it can also be termed. The reversing of any motor can be very easily carried out at the controller, and either of the above speeds can thus be efficiently obtained in either direction of speed rotation.

LIGHTING. The lighting section of the switchboard would be divided into three panels, one for each phase. Advantage can be taken of the star-connected generator, previously mentioned, for reducing the voltage for lighting purposes. The voltage across any of the three phases would be 250 volts, but if the neutral point of the star connection is brought out as a fourth wire, the voltage between this wire and any of the other wires is much lower than that between any of the phase wires themselves. We can thus take advantage of this to reduce our voltage for lighting without the use of transformers. The lighting of the ship would be balanced between this fourth wire and each of the phase wires. Many advantages may be claimed for the gas and electricity system: labour for working would be reduced; the consumption of fuel, with the saving of bunker space. The cargo winches and hoists would be more efficient, and would be started up without the draining and heating, etc., which take place with a steam winch. The wiring for the ship's lighting would be as usual, of the best workmanship and material to ensure success. Mains could be led to each deck, running fore and aft of the ship, with distribution boxes in the most convenient positions for distributing the current to the different winches, small motors, etc., the main cables being properly encased to ensure the installation being watertight. HEATING.—I think you will agree that heating by steam is very unsatisfactory. Steam has to travel through long lengths of small pipes to get to the radiators, and by the time it reaches them it has lost half of its heat, while electricity can be transmitted any distance with a loss of about 2 per cent. to the radiators, which can be more efficiently placed than steam radiators, and better controlled. COOKING.—With regard to cooking by electricity it has been found by actual experience that it is far more cleanly, economical and easier to apply than coal. Applied on board ship, coal and ashes could be banished from the galley altogether, and as this is usually anything but a commodious space, it would be a great advantage, as well as cleaner.

REFRIGERATOR.—All refrigerating machinery could be very well operated by electric motors. They would, of course, require to have a large range of speed, somewhere about 40 to 120 R.P.M. It would enable the refrigerator to be installed in the most suitable place without regard to the means of getting steam to it, with resulting economy.

EFFICIENCY.—I shall now deal with the question of the efficiency of the suction gas plant as compared with the steam plant, as I propose to show the coal consumption per horse power for both types of plants. I propose to take the actual tests taken on a 750-H.P. suction gas engine and compare it and a high-class Corliss steam engine working with condenser and economizer. It is necessary to take this course, as I have not been able to get actual coal tests of a donkey boiler under ordinary working conditions. In the case of the steam engine the coal consumption under test conditions was 2 lb. of coal per brake horse power hour at the flywheel. To analyse the losses from the coal fed into the furnace, the first are due to radiation, unburnt hydrocarbons and ashes. Of the losses due to excess air in the products of combustion we find that some 35 to 45 per cent. of their sensible heat is recovered by the economizer. Of the total heat of the coal fed into the furnace 71·3 per cent. appears as steam at the boiler stop valve. Six per cent. of the total amount of heat in the coal is lost by radiation from the steam-pipes connecting the boiler and engines. The greatest loss is found in the latent heat of the exhaust steam, and to condensation in the engine itself, which is approximately 52 per cent. of the total amount of heat generated. The total losses therefore amount to 86·82 per cent., leaving 13·18 only available. The mechanical losses of the engine amount to about 15 per cent., therefore the total amount of heat supplied to the boiler from the coal which appears as useful work is 11·2 per cent. The mechanical efficiency of the engine is not far out, I think, at 85 per cent., especially as the engine in question drove its own auxiliary pumps. The gas engine has been found on test to obtain one brake horse power per hour for an expenditure of 8,500 B.T.U. from the coal fed into the gas producer. We assume that the coal for the producer has the same calorific value as the coal for the steam engine, that is, 13,650 B.T.U. per lb. of coal. The loss due to radiation and ashes in the producer amounts to 28 per cent. of the total; allowing for the fact that the steam required for making gas can be raised when running from the heat of the exhaust gases from the engine, which amounts to about 13·6 per cent., we get an efficiency of about 83·6 per cent., which appears as gas at the outlet of the producer. This figure is made up as follows: 28 per cent. due to losses in ashes, etc., and 2 due to losses in the auxiliary machinery; a total of 30 per cent., from which must be taken 13·6 added by the exhaust steam heating, leaving 83·6 per cent. efficiency, compared with the 71·3 per cent of the steam boiler. There is no loss in the gas after it leaves the producer, as the subsequent scrubbing and cleaning process does not affect its calorific value to any measurable extent. Taking the producer efficiency at the round figure of 80 per cent., from each pound of coal fed into the producer we get 10,000 B.T.U., which appears as gas available for use in the engine; we must, however, take from this figure 9 per cent., which, from a number of tests, represents the stand-by losses of the producer, leaving 10,000 B.T.U. really available. We therefore get the quantity of coal for one brake horse power for one hour as 8,500, divided by 10,000, which equals ·85 lb. of coal per brake horse power for the gas engine. This compares with 2 lbs. in the case of the steam engine.

The fuel costs of the gas engine will thus not exceed one-half those of the steam engine. There is no reason whatever why the figures for the gas engine could not be maintained if used for the purpose of driving an alternator for supplying current for the auxiliaries on board ship; the losses due to the distribution of the current, etc., would not amount to more than, say, 20 per cent. for the electrical plant, the losses due to distribution of steam to the auxiliaries would be, on the most favourable conditions, a minimum of 75 per cent. It is not claimed that the first cost of suction gas electrical plant, power for power, is less than that of steam, but as only 20 per cent. of the power generated in the gas engine is lost in the subsequent distribution, compared with 75 per cent. in the case of the steam plant, it would only be necessary to install a gas plant of less nominal power to do the same work. Assuming that the coal consumption per B.H.P. hour was the same for both boiler and producer, it follows that the bunker space required for the producer would be only half that required for the boiler; however, as the coal consump

tion per B.H.P. hour of the producer is less than that of the steam boiler, the actual bunker space required would be very much less.

The weight of a 300-H.P. producer is approximately 19 tons and occupies 14 ft. by 10 ft. 6 in. by 16 ft. The weight of the engine is 30 tons, and occupies 16 ft. by 9 ft., and is 12 ft. high; thus the total weight of combined producer and engine is 30 tons plus 19 tons, total 49 tons.

It has been stated that the breakdowns in steam engines are one in eight, while the breakdowns in gas engines is one twelve, another factor in the question.

The cost of upkeep of a producer plant of course varies somewhat, but from my experience it should not exceed more that £10 to £11 per annum in a well-designed and constructed plant of 300 B.H.P. The items which wear out are the fire-brick lining of the generator, and bottom fire-grate. The coke in the scrubbers should only require renewing once a year, and this only if the producer has been working constantly for this period. The producer requires a certain amount of water. This is used for two purposes, *viz.*, for converting into steam for the production of gas, and for cleaning the gas in the scrubbers. The total consumption for both these items varies from $1\frac{1}{2}$ to 2 gallons per B.H.P. hour. The greater proportion of water is used in the scrubbers, but as there is no objection to the use of sea water for this operation, the amount of fresh water required would be very little. Suction gas is non-odorous and poisonous, but as the whole plant is working below atmospheric pressure and the producer only generates just sufficient gas for the load on the engine there is no possibility of escape when at work or standing by. When starting up, a small quantity of gas is blown to waste through a properly constructed waste-pipe, so that there can be no danger from this source. The usual method of shutting a gas plant down for standing by is to open the waste-pipe cock and the ash-pit door to allow a draught of air to pass through the generator to keep the fire alight. The stand-by loss is the amount of fuel consumed during this period of rest. In Mr. Dowson's book, recently published, on "Producer Gas" will be found a complete comparison of the stand-by losses between gas plants and steam boilers, which shows an enormous difference in favour of the gas plant. When I say that for a given power the gas producer has far less radiating surface than a boiler and occupies less space, has fewer external settings to be heated up, and moreover requires less fuel to make up this loss than in the case of a steam boiler, the enormous difference in the stand-by losses will be more readily understood. For steam boilers the average is 2 lbs. coal per H.P. hour, for gas plant it is 0·17 lb. per hour.

In a paper read by Mr. E. Shackleton before the Institute of Marine Engineers (Vol. XX.), he gives some very interesting figures relating to the coal consumption required for loading or dischagring cargo by steam; he bases his figures on a steam plant of 200 B.H.P. and gives the fuel consumption of this for twelve hours as 5 tons 7 cwts. 16 lb., and goes on to say:—"Referring to the cargo discharge consumption the writer is of opinion that the majority of engineers are acquainted with the excessive fuel consumption of the average steam winch, which (on account of its very low efficiency, owing to condensation losses, etc.), may probably be put at 5 lb. per H.P. per hour as not too high an estimate." Comparing this figure with the coal consumption of the electrical winch driven from the suction gas alternator, I will refer you to the coal consumption of the gas plant which I gave at ·85 lb. per B.H.P. hour on the gas engine. To arrive at the consumption for the winch we have to take into consideration the distribution losses of the electrical system. I stated that this figure was 20 per cent. Supposing that we take this at 25 per cent., we shall get a coal consumption of 1·06 lb. of coal per brake horse power with our electrically driven winch, as compared with 5 lb. of coal for the steam-driven winch. This means that the coal consumption on, say, 24 hours' continual work with 300 B.H.P. gas engine would be just over 4,800 lb. of coal, while the coal for the steam engine would be 2,400 lb. or just five times as much. Dealing with the amount of mechanism in the two forms I have described, that is, between the producer and the steam boiler, the producer is a comparatively simple piece of apparatus, as no parts of it are subject to any pressure, and after the gas is cleaned and scrubbed no physical change takes place until it reaches the engine, no feed-water pumps are required, and the amount of cleaning required is extremely small. On the other hand, the steam boiler has to be well maintained, as it has to work under high pressure. Care has to be taken with the feed water, and interior of the boiler must be kept free from scale, etc. The steam can lose a great amount of its heat in the steam-pipes. The valve gear of the gas engine is extremely simple, and when once set cannot be tampered with. As for the alternating current generator and induction motors, these are simplicity itself, far more simple than continuous current motors. The losses that occur in the distributing cables at the most only amount to about 2 per cent., and these cables require absolutely no attention when once installed.

The undernoted test on a 200-H.P. Hornsby Stockport suction gas engine shows the cost of working, including allowance for depreciation and capital expenditure:—

Coal.—·85 lb. per B.H.P. hour, 170 lb. per hour at 12s. per ton	11 pence.
Labour.—One man with labourer assistant 53 hours at 40s. per week	9 „
Water.—Two gallons per B.H.P.H. at 6d. per 1,000 galls.	3 „
Capital Expenditure.—Engine and plant, £1,680. Interest 5 per cent. Depreciation $7\frac{1}{3}$ per cent. and maintenance $2\frac{1}{2}$ per cent., making a total of 15 per cent.	23 „
Oil, waste and stores	3 „
Making a total cost of per hour	49 pence.

This gives a cost of one farthing per brake horse power per hour for the driving plant.

At the Powell Duffryn Aberdare Collieries Electrical Equipment, started up in 1905, the alternators are as follows:—

	No. 1.		No. 2.
Output	2000 k.v.a.	....	1000 k.v.a.
Pressure	3300 volts.	....	3300 volts.
Frequency	50	....	50
Speed	83 revs.	....	94 revs.
Height above floor	17 ft.	....	13 ft.
Floor space with horizontal engine	988 sq. ft.	....	720 sq. ft.

The motors are as follows:—

	No. 1.				No. 2.		
	Variable Speed.				Constant Speed.		
B.H.P.	150	75	50	..	100	50	25
Volts	3000	3000	3000	..	3000	3000	3000
Diameter of Rotor	$42\frac{1}{2}$	30	25	..	42	24	$19\frac{1}{4}$
Speed (full load)	290	305	305	..	290	485	485
Efficiency:—							
Full	80·5%	89%	85%	..	90%	91%	87·5%
Three-quarter	89%	88%	84%	..	91%	90%	88 %
Half	87·5%	86%	82%	..	91%	88·5%	87 %
Power Factor:..							
Full	·78	·82	·72	..	·87	·83	·85
Three-quarter	·71	·78	·63	..	·86	·77	·80
Half	·6	·68	·5	..	·82	·65	·7
Temperature rise Centigrade	·35	39·5	45	..	37	60	30

These are induction motors, and those working below ground are totally enclosed. All switch-gear below ground works under oil. The fans are rope-driven by 180 B.H.P. 3000 volts motors, and deliver 150,000 cubic feet of air per minute with $3\frac{1}{4}$ in. on water gauge. The cost per unit delivered to the transmission lines with an output of four and a half million units per annum, load factor 37 per cent., using unwashed coal, small (13,000 B.T.U.), at 4s. 2d. per ton is—

Works costs	0·18d. per unit.
Int. and dep. on Station, 10 per cent.	0·185d. per unit.
Total	0·365 per unit.

It is hoped to bring this cost below 0·3d. per unit with 45 per cent. load factor. There is no danger whatever in any electrical system if it is used with ordinary care. Here we have 3000 volts motors, mains and switch gear below ground; four years have elapsed, and there have been no accidents; a 500 volt current has proved fatal and, of course, so has 2000, but a 2000 volt current is treated with greater care, and is better installed, and leak indicators, etc., are kept working.

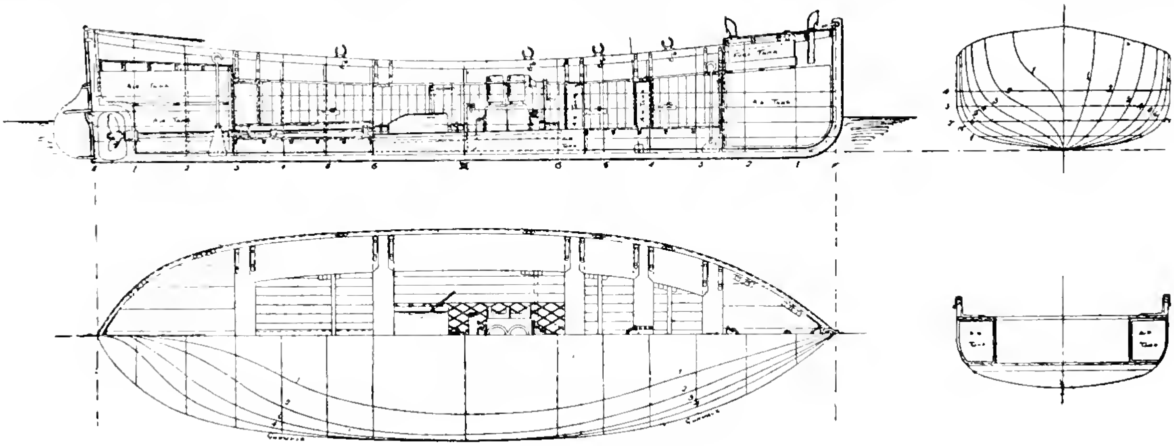
In conclusion, I think that as an allowance of $7\frac{1}{2}$ per cent. is usually reckoned as a fair margin for depreciation of the

plant on land installations, perhaps at sea this might be a little heavier, say 10 per cent., while for maintenance 2 per cent. would suffice; thus, we get $12\frac{1}{2}$ per cent. as an annual charge on the capital outlay of the installation. The comparison which I have endeavoured to make between the donkey boiler with its scattered units and long lengths of steam piping, and the suction gas-plant with its centralized generator, gives the case fairly for each system. I am indebted to Messrs. The British Westinghouse Co., Messrs. Campbell & Co., and Mr. Durtnall, for their courtesy in supplying me with lantern slides and particulars for use in this paper.

SEAMLESS STEEL BOATS.

THE acceptance of motor lifeboats by the Board of Trade as part of the equipment of passenger steamers and of those passed under the Emigration Act shows that confidence has been gained by makers proving that they can build reliable and efficient machinery for the purpose indicated. We inspected several boats at the Motor Boat Show held at Olympia last March, and were impressed not only by the variety and style of the boats, but by the improvements in the machinery, and the ingenuity displayed in connection with the details. We have pleasure in illustrating a seamless steel boat fitted with a motor, made by the Seamless Steel Boat Company, Ltd., Wakefield.

The lifeboat illustrated will carry a total of thirty-eight passengers at a speed of 8 miles per hour, and could tow the remainder of the ship's boats in case of accident, oil storage capacity being provided for over 200 miles run. Air-tight chambers of yellow metal are provided of sufficient capacity to keep afloat the boat and passengers, if by any accident, the boat were to get filled with water.



Seamless Steel Boat

A Fitting Education.—One speaker at a recent dinner advocated a systematic education for the nation so that the average intelligence of the population should be raised, hoping by such means to improve the conditions of life all round and induce or compel a selection of mating to raise a better average mental pabulum and character, indeed to place education and phsycology on a pinnacle which would tend to spoil the romance of life without probably touching the tragedy of it; men cannot be turned out arbitrarily like pies, nor is it desirable they should be. Another speaker pointed out that the process of education given by public school and University did not necessarily make an educated man. A good engineer with a technical education is all the better for it, but he must have the root of the matter in him first.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

Disasters.

ALMOST at the moment when the recommendations of the Commission appointed to inquire into the circumstances surrounding the loss of the steamship *Maori* on the coasts of Cape Colony were being published, another disaster emphasized the need for better lighting those dangerous spots. At half-past ten on the night of the 15th September, the Bullard King liner *Umhlali* went on the rocks at Cape Point, some five miles from the port of Cape Town. She was then on her voyage from London to Durban with some thirty-nine passengers and a valuable cargo, which comprised a considerable quantity of drapery goods, electrical machinery, and some seventy tons of dynamite. The position was so serious that the ship had to be abandoned, a boat being unfortunately capsized in the process, whereby one life—that of an infant—was lost. The majority of the passengers were taken aboard the Union Castle Liner *Galeka*, which came up early on the morning of the 16th September on her northward voyage, and she took the rescued people back to Cape Town. The recent series of wrecks off the South African coast is indeed remarkable, and should have the effect of forcing the authorities to improve the lighting of the coasts and to encourage the installation of wireless telegraphy.

The Allan Line has suffered what may be called a sentimental, rather than a pecuniary loss in the wreck off Mistaken Point, Trepassey Bay, Newfoundland, of their steamship *Laurentian* on her voyage from Boston to the Clyde. For the *Laurentian* was one of the older and smaller vessels of their fleet, having been built for them by Messrs. Robert Steele and Co., of Greenock, as long ago as the year 1872. She was originally called the *Polynesian*. But in 1893 she had new engines and boilers, and was practically re-constructed in her passenger accommodation, and came out again as a new ship under her present name of *Laurentian*. Her valuation for insurance purposes was but £10,000, and, fortunately, there was no loss of life amongst her forty passengers who were all safely landed soon after the stranding. The ship herself, however, soon went to pieces and there will be little salvage of cargo or materials.

The *Waratah* being still unheard of, and no wreckage which could be identified as coming from her having drifted ashore, or been observed at sea, it was determined by the owners, the underwriters, and the Commonwealth Government to organize a joint expedition to go in search of her. Some weeks however were spent in settling the lines on which the searching vessel was to proceed so as to scour the ocean exhaustively and satisfactorily, and to retain the services of a suitable ship for the work, and it was not till the 11th September that the Union Castle Liner *Sabine* which had been selected for the work was able to put to sea. If the *Waratah* be still afloat this delay matters little,

for she has on board, it is said, provisions which would last her passengers and crew some eighteen months, and it was far more important to send the *Sabine* to sea fully prepared for her search than to save a day or two in sending her off. As it is she carries enough coal to enable her to be away for three months—cruising at her most economical speed. She has also been equipped with a searchlight and carries a party of bluejackets to work it. Further, there is a naval officer aboard to act in consultation with the master of the ship as to the steps to be taken to scour the ocean, and to calculate the probable effect on the big ship's drift of the winds and currents which prevail in the Indian Ocean. The one hope for the safety of the steamship, and of those on board of her, is that the delay in her arrival may be due to the fact that she is hopelessly deprived of her propelling power—that she has suffered some injury which has disabled both her screws and which is beyond the power of her engineering staff to remedy. In a twin-screw ship the breaking of a shaft, or the loss of a propeller would not, of course, be sufficient to so disable her. The most probable cause of trouble would be the breaking of the main steam pipe in heavy weather, such as she undoubtedly experienced. In this connection one may cite the case of the old single-screw Cunard Liner *Pavonia*, which lost the use of her engines in the Atlantic through the shifting of her boilers in heavy weather. The energies of her crew were taken up on that occasion in wedging the boilers up so that they might not take charge and go through the skin of the vessel—they never had a chance to get steam on the ship. If the *Waratah* were in fact so deprived of the use of her engines there is no reason why she should not drift, and that undiscovered, for months, as was seen in the case of the *Waikato*, which vessel drifted at the rate of twenty miles a day to the eastward for a hundred days. This distance being computed as the crow flies, the actual ground traversed must have been far more. The hydrographer's department, taking the experience in regard to that vessel as a basis, has plotted out the section of ocean over which it is worth while for the *Sabine* to steam on her great quest.

It may be of interest to mention that the *Waratah's* engineering staff comprised :—Chief engineer, Mr. G. W. Hoader, of London. Mr. A. U. Hunter, of Perth, second engineer. Messrs. T. Humphrey, of Rochester, and F. T. Hunt, of Margate, respectively senior and junior third engineers ; fourth engineers, Messrs. J. H. Jamieson, of Aberdeen, and J. Hamilton, of Arran ; fifth engineer, Mr. F. Monk, of Brick ; and Refrigerating engineer, Mr. R. A. Hamilton, of Glasgow. Her master was Captain J. E. Ilbery, who had been half a century in the same employment, and had been thirty-six years in command. He is said to have made more trips between the United Kingdom and Australia than any other shipmaster.

A good deal has been written in the press to suggest that the *Waratah* was unstable, or, at all events, slow to rise to the seas. But I take it that little importance need be attached to these statements. Wherever an accident happens, be it to a ship or to a passenger train on a railway, there are always some people who write to say that they providentially missed the opportunity of travelling on this particular occasion, or that they abstained from taking advantage of it in consequence of some presentiment or other. But we have no statistics of the occasions on which people have such presentiments and nothing untoward has occurred to justify them !

Fast Atlantic Passages.

The great Cunarders have been doing well of late, though it would appear that few people really knew the reason for the improvement on their speed. Engineers, and people who term themselves experts, attributed the increased efficiency displayed by the machinery to the fact that the type of propellor had been changed and that a design more suited to the form of the ship and the power of the engines had been obtained. But the *Electrical Review*, as quoted by the *Daily Mail*, seems to know better. It tells the public that " it is strange on the face of it, that apparently small details should be the means of converting a twenty-three knot boat into one of twenty-six knots ; but it is no exaggeration to say that the records of the *Mauretania* are entirely due to a better understanding of the electrical conditions on board." Surely this will be news to Messrs. Swan & Hunter & Wigham Richardson, and, indeed, to the engineering staff of the Cunard Company. What a pity they went to the expense of changing the propellors, if this be indeed the case ! But, seriously, what can the writer in the *Electrical Review* be driving at ?

Anyhow the *Lusitania* regained the westward record by reaching the Ambrose Lightship at 4.48 p.m. on the evening of Thursday, the 2nd September, after a passage of four days eleven hours and forty minutes, which was two and a half hours better than the record of the *Mauretania*. Her steaming seems to have been very even, the best day being 652 nautical miles, and her worst 647 miles. She was not, however, allowed to enjoy her supremacy for long, as the following week the *Mauretania* decreased the time of westward transit by seven minutes. On this occasion she steamed 658 knots in one day.

The Allan Line.

which is, of course, the premier Company in the Canadian trade, having been established by the Allan family, of Montreal, generations ago, and having carried the Royal Mails in its steamships since before the Crimean war, has for some time been the subject of persistent rumours. The general purport of what has been said has always been to the effect that it is intended that the Line shall be absorbed by the Grand Trunk Railway of Canada. Several circumstances seem to favour the probability of some such arrangement. For of the three great lines which share the St. Lawrence traffic, Allan's alone have no other partners. The Canadian Pacific steamers are, of course, owned by the great railway whose name they bear, and the Dominion line is a limb of Mr. Morgan's Combine. Moreover, the Grand Trunk Railway has for some time professed its intention of having a fleet on each of the Oceans which wash the shores of Canada, and, if the Allan Line were willing, an arrangement between the two would be a very suitable mode of strengthening the hands of both organizations. But the change which gave occasion to the present rumours seems to have been merely a domestic rearrangement. A circular has been issued by Messrs. James & Alexander Allan—who are the Glasgow house—that they are retiring from business and that the work in connection with the steamship business, hitherto in their hands, will in future be carried on by Messrs. Allan Brothers & Co., Limited, who are the Liverpool side of the business. This Company will therefore in future manage the work of the Glasgow house, as well as that of London and Liverpool, where it has been so long established. It will, in fact, take over the Bothwell Street Offices of the late firm of J. & A. Allan in Glasgow, and thus, as far as the outside public is concerned, the whole affair is small indeed. There is, however, a suggestion that in the future the Montreal house will play a larger part in the management of the Company's affairs. This is, of course, a reversion to the practice of early days. But it may also be a step towards a partial carrying out of the much talked arrangement with the Grand Trunk. We shall see.

The Union Castle Line.

Not published as a paragraph, but merely to be discovered from an examination of their most recent sailing-list, is an interesting announcement by the Union Castle Company. It is that they have decided upon the names for the four twin-screw liners which they have now under construction. It will be remembered that in January of the present year it was announced that two thirteen thousand ton mail steamers had been ordered, one from the Fairfield Shipbuilding Company, and the other from Messrs. Harland and Wolff. These ships are to be known as the *Edinburgh Castle* and the *Balmoral Castle*. At the same time that the determination to add these mail steamers to the fleet was made public it was said that an intermediate steamer of 7,500 tons was also ordered of Messrs. Barclay, Curle and Co. Later it transpired that this order covered, not one, but two vessels. These are to be called *Garth Castle* and *Grantully Castle*. All four names are good. They are also reminiscent of former vessels of the fleet. What changes a comparison of the old ships with their successors indicate ! The *Edinburgh Castle* of early days was built in 1872 by Messrs. Robert Napier & Sons, and was of no more than 2,679 tons. After doing her work in the first days of the old Castle Line, she was sold to the Compania Transatlantica of Barcelona.

renamed, and eventually broken up. The *Balmoral Castle*, which was constructed in the same yard some four years later, was of about 3,200 tons gross register. She in her turn was disposed of, renamed more than once, and so passed out of existence.

It is pleasant to see the name of *Garth Castle* once again figuring in the Union Castle lists, for it is reminiscent of the founder of the line, being the name of the Scottish home of the late Sir Donald Currie, who did so much for the travelling public and for South Africa generally. The original ship of this name was built in 1880 at the Fairfield yard and was a vessel of some 3,700 tons. She passed out of the fleet in 1901 and is still afloat under the name of *Ismaila*, being now under the flag of the Khedivial Mail Company.

The old *Grantully Castle* was a trifle smaller than the last-named ship and was built in 1879 by Messrs. Barclay, Curle and Co., the firm who are now preparing her successor for launching. She was disposed of to the Booth Steamship Co., of Liverpool, in 1896, and is now known as the *St. Augustine*. It will be seen that these reinforcements will strengthen the fleet so as to make it more than capable of dealing with the exacting requirements of the new mail contract, and I understand that the new ships may be expected to be at work by the time the present arrangement draws to its close, so as to be ready when the new *régime* commences.

Fishguard *v.* Liverpool.

A good deal of capital has been made by the opponents of Liverpool and its Dock Board of the fact that the Cunard Company has found it desirable to make its mail steamships call at Fishguard for the purpose of landing their mails and passengers. This move, of course, follows on the departure of the White Star Line to Southampton, as far as regards its mail steamers, and upon the more recent arrangement whereby that Company's intermediate steamers, which still hail from the Mersey, now visit Holyhead. It would seem however, that Fishguard and Holyhead are not rivals, but allies of Liverpool. The Dock Board has stated that their introduction into the trade has not in any way affected the revenue of the Trust, and it may be inferred that the greater the facilities which they are able to offer to the travelling public and to the International mails, the less the probability that the steamers which use them will be forced to forsake the Mersey for English Channel ports. Nor is it likely that any developments at present probable, or indeed possible, will enable them to injure Liverpool. For neither Fishguard nor Holyhead have the docks or other facilities which would put them in a position to set themselves up as home ports in distinction to being what they are, mere ports of call. The real sufferer by the recent development is the London and North-Western Railway. It is not, of course, affected by the Holyhead development, because its specials serve that port equally with Liverpool. But as regards Fishguard, the Great Western steps in and takes the traffic altogether away, both as regards landing dues and railway charges. No wonder the Great Western strained every nerve to make records with the specials which brought the first Cunard mails through to Paddington!

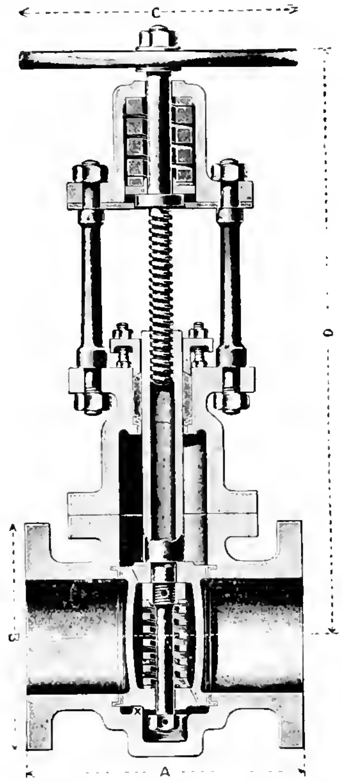
Comforts for Ships' Crews.

One of the most desirable things in connection with the Mercantile Marine is undoubtedly the raising of the standard of comfort for the men in order that a better class of British seamen may be attracted into British ships. The standard of comfort on land for all classes of society has steadily risen of recent years, whilst afloat—save, indeed, in the case of the great liners—there has been no corresponding advance. Sir Alfred Jones has always interested himself in this question and I notice that in two ships recently added to the Elder Dempster Fleets a new and interesting departure has been made. In the *Shonga* and the *Winnebah*, recently launched from the yard of Messrs. Irvine's of Hartlepool, for the West African services, it is intended to provide libraries for the use of the crews. The advantage of this small addition to the ship's equipment will be appreciated by all those who know anything of the conditions of life at sea.

Submarine Craft.—The D1, the newest submarine of the British Navy, arrived at Portsmouth yesterday from Barrow, where she was secretly built. She is propelled by twin screws, and has a surface speed of 16 knots and a submarine speed of 10.

PARALLEL SLIDE FULL BORE VALVE.

Some interesting details of construction are embodied in the "Excelsior" Parallel Slide Full Bore Valve which we illustrate by a sectional elevation in the adjoining diagram. In many of the valves of this type considerable friction is set up when opening and closing, and one of the main features of the new design is the removal of this objection, which is effected by making the width of the block less than the distance between the valve seats, and in this way avoiding any abrasive or scoring action between the valve seats and faces. A positive shutting off of the steam is secured in



the new design on both the inlet and outlet faces, whereas in the ordinary forms of construction no positive action exists, other than that due to the steam pressing the valve block against the faces at the outlet side, that being the case even where the valve block is slotted or in two pieces forced apart by a spring: the chattering noise in the latter arrangement being accounted for by the continual opening and closing at the inlet side, so that all such devices are virtually only single-faced valves.

It is claimed by the manufacturers that their closing arrangement counteracts all possible jamming or leakage of the valve due to the expansion and contraction of the valve spindle owing to the frequent variations of temperature.

With reference to the diagram it will be seen that the positive closing of the valve is obtained by forming the valve block in halves, having oppositely inclined planes sliding upon one another so as to introduce a wedging action when closing, the two parts being guided by dove-tail grooves.

The outer half is mounted between shoulders on the spindle so as to be carried directly thereby, while the inner half is mounted freely on the spindle, and is acted on by a spiral spring against a nut at the lower end of the spindle. When not in the closed position the two faces of the valve block are kept fully distended between the shoulder on the spindle and the nut at the lower end by the influence of the spiral spring, thus reducing the width of the block below the distance between the faces of the seats. The spring acting along the line of the valve faces does not set up any abrasive or wearing action on the seats or faces. When the valve is being closed the block travels down as a whole until, when opposite the seats, the inner half comes in contact with the stop X, and on the downward movement of the spindle being continued, the outlet half acting against and pressing the spring seats, causes a relative movement between the two halves, and consequently a wedging action owing to the inclined surfaces, which produces a positive closing action of the valve on its seats. In a converse sense, in opening the valve the least upward movement of the spindle of the outlet half of the block is assisted by the upward thrust of the spring until the nut engages the inlet half of the block, when the valve as a whole, having had its width reduced, can be lifted easily without friction or risk of abrading the seats.

These valves are manufactured by Messrs. Alex. Turnbull & Co., Ltd., of Bishopbriggs, Glasgow.

The Russian Navy.—We have received some interesting particulars from a correspondent, with reference to the Russian Navy, which we feel sure our readers will be pleased to have. After the Russo-Japanese War, there arose in the Russian fleet, principally among the younger part of the crews, a sense of the necessity of fundamental reforms in all the branches of the naval department in order to avoid further defeats. Russia having three separate sea-washed shores which are of great importance to her, and having no intermediate bases, there is at present little or no possibility of forming such fleets in these seas with which her neighbours would have to reckon, and therefore, in spite of the policy of the Russian Naval Ministry, there exists in Russia a considerable party which is working to develop the various lines of naval power, taking into consideration the peculiarities of her geographical position. The latest novelty in this direction is a project for an autonomous submarine cruiser of 4500 tons, invented by the naval engineer B. Shuravleff, who formerly worked on the problem of increasing the sea-going capacity of modern battleships and succeeded in getting his ideas applied on the new Russian ships (ships of the line), which have latterly been laid down. His proposal of a submarine cruiser has as its object the building of a ship capable of acting in the Baltic Sea, as well as in the Pacific, wherefore, having regard to the former purpose in view, it has—in comparison with other submarines—a very low hull, *i.e.*, 25 ft. over all (together with the conning tower), with a displacement of 5500 tons. This feature makes it possible for the cruiser in question to attack ships of the line even in the shallow waters of the Baltic. In consideration of the latter purpose it is to have a tremendous sea-going capacity, *i.e.*, 18,000 miles, which is of immense importance for Russia, inasmuch as she has only one naval base in the Far East—Vladivostok, and the probable repetition of the necessity for sending ships from the Baltic. The speed of the cruiser under water is to be 26 knots, so as to make it possible for it to act against large ships. For defence against the smaller projectiles of the enemy, if for any reason the cruiser should not be able to dive in time, it is to be furnished with a 2-in. armoured deck, with a substantial incline and an interior shell of $\frac{3}{4}$-in. thickness, which will permit of its diving, even in the case of injury to the fastenings of the armoured deck from a shell which has taken effect. The armament of the cruiser is to consist of thirty-six torpedo guns of quite recent construction, adapted for holding torpedoes for a considerable time, and which have at the same time a wide range of fire. Besides torpedoes the cruiser is to carry about 200 floating mines which can be placed either under or on the water. As secondary armament the cruiser is to have five 120 mm. quick-firing guns arranged in a revolving tower. Special construction of Kingston valves and tanks will be adopted, so as to allow of the very quick diving action of the cruiser and to give it a sensitive balance. The naval engineer Shuravleff has made three variations of this cruiser, one fitted exclusively with Diesel internal combustion engines, which are being used more and more in the Russian fleet, and two with Curtis turbines and White and Forster boilers—the latter being well known in the English fleet—and new boilers designed by the Russian inventor Tabulevitsch. In the two latter variations of the cruiser there exists a special arrangement for driving her at an economic speed, which allows the cruiser the same sea-going capacity as it has with internal combustion engines, *i.e.*, 18,000 miles. Although the project for this cruiser was intended especially for Russia, it is not unreasonable to assume that submarines of analogous construction will shortly appear in other fleets. Eighteen guns on deck having a large range of fire and allowing of volley firing will undoubtedly augment the number of hits made by torpedoes and place such submarines, as regards effective action, on a par with floating battleships, which act on the principle of the concentration of fire on the enemy. At the same time it is claimed that such a submarine cruiser will be in perfect safety and its comparatively large tonnage will allow of its being manned for a considerable time and removes one of the principal defects met with in submarines, *i.e.*, the impossibility of action when same are at a distance from their bases of operation. This indicates that in all probability we are on the eve of the formation of a submarine fleet, which shall have all the properties of an ideal fleet.

Mr. James A. Smith, M.I.N.A., has designed a new 50-ft. cabin river launch to the order of the Baron Barreto. The launch is intended for use on salt water as well as on the Thames. The hull, which is being built by Meakes & Redknap, Marlow, is of Mahogany, and measures 49 ft. on the waterline by 7 ft. beam. A handsomely fitted cabin, for day use, is situated aft and the machinery is forward. The launch is being finished in a very high-class manner, and will form a notable addition to the river fleet. She has a straight stem, a gracefully-moulded slipper stern, and is decked over forward and aft. Steam machinery by the New Lowca Engineering Co. is being fitted.

The Association of Engineers-in-Charge.—The Council of the Association of Engineers-in-Charge have unanimously elected Mr. Henry Adams, M.Inst.C.E., M.I.Mech.E., etc., as their president in succession to Mr. James Swinburne, F.R.S., M.Inst.C.E., and an attractive programme has been drawn up for the new session, including some good papers and several social functions. Among the members of the association Mr. Adams is one of the oldest of the engineers-in-charge, having so far back as 1865 been in responsible charge in the outdoor department of Sir W. G. Armstrong and Co., of Elswick Works.

Blackfriars Bridge.—The ceremony of the reopening of Blackfriars Bridge after its widening was performed by the Right Honourable The Lord Mayor of London, Sir George Wyatt Truscott, on the 14th September. In connection with this event it is interesting to note that the first bridge was commenced in 1760 and was completed in 1769 at a cost of £152,840. This bridge lasted until the erection of the present bridge in 1865, which was completed in 1869 at a cost of £401,131. Since that time the traffic has increased to such an extent as to render the widening of the bridge necessary; the number of vehicles crossing per day being over 20,000. The introduction of the tramway system on the Embankment by the London County Council accentuated the necessity of provision of further width, if the bridge was to carry a tramway in addition to the ordinary roadway, and the result of negotiations between the London County Council and the Corporation of the City of London resulted in the latter undertaking to widen the bridge by 30 feet, thus giving it a total width of 105 feet between the parapets. The work was entrusted to Messrs. Sir William Arrol & Company, at the contract price of £203,000. This widening will make the bridge the widest of the road bridges spanning the Thames.

AN IMPROVED STEERING ENGINE.

THE failure in the past of steering engines, in which the movement of the tiller ropes was taken directly from a reciprocating piston instead of from a revolving drum, has been due entirely to their valve mechanism. Either the rudder movement was too sudden, or the rudder could not be compelled to retain the desired position perfectly and indefinitely. The Nash-Century Steering Engine, which we illustrate in the adjoining Fig. 1, is made with a novel valve motion by means of which, it is claimed, these objections are completely overcome. As will be noted, the engine is also free from a multiplicity of wearing and power-absorbing parts, such as drum, spur and hobbed gears, large bearings, etc. The piston rod is prolonged equally from both ends of the steam cylinder, and terminates in sheaves through which the tiller ropes pass in such a way as to give them a travel at the quadrant equal to twice that of the piston. Steam pressure admitted near each end of the cylinder acts upon both ends of the piston to hold it in position, and at all times balances it against the pressure on the rudder.

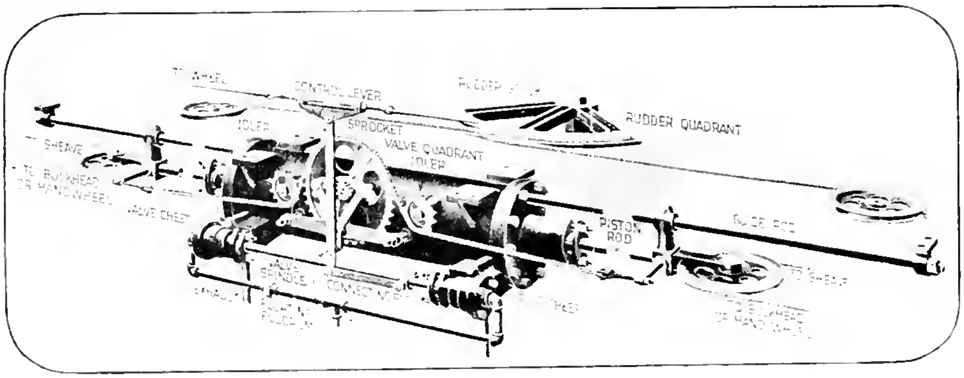


Fig 1

The valves which admit pressure to the cylinder are of the piston type and have a common spindle. When the controlling gear is stationary these valves are in mid position; that is, the valve rings cover the steam ports with slight overlap and prevent admission of steam to the cylinder.

The operation of the steering wheel to port or starboard as desired causes the control lever to move. This control lever, swinging about the floating fulcrum, transmits its pull to a connecting rod, the other end of which communicates with the valve spindle. The resulting movement of the valve spindle uncovers the ports, admitting steam through the valve at one end of the cylinder and exhausting through the valve at the other end. The unbalanced cylinder pressure then moves the piston rod, and thus, by means of the sheaves attached to the ends of the piston, the cables to the rudder quadrant are moved, imparting corresponding movement to the rudder.

At the same time the movement of the piston causes the block chain attached to the sheave blocks at each end of the piston to rotate the sprocket and its concentric pinion. The sprocket and pinion are keyed to the same shaft and are practically one piece, the pinion meshing with an arc which swings about a centre on a bracket on the cylinder casting. Extending from the centre pivot of the arc, and diametrically opposite to the toothed part, is a projection which forms the fulcrum from the control lever. This explains why we previously spoke of this fulcrum as "floating." The movement of the arc makes the fulcrum travel in a radial direction, and opposite to that taken by the valve spindle in opening for steam.

Thus the instant the piston has reached the desired position it has by its own action, as transmitted through piston rods, chain, sprocket, pinion, arc, fulcrum and connecting rod, automatically closed the valve and shut off the steam. To keep the piston moving it is consequently necessary to keep the control lever moving by operating the steering wheel: in other words, the steering wheel operates against an automatic cut-off, which constantly acts to prevent movement other than that desired as indicated by the steering-wheel dial.

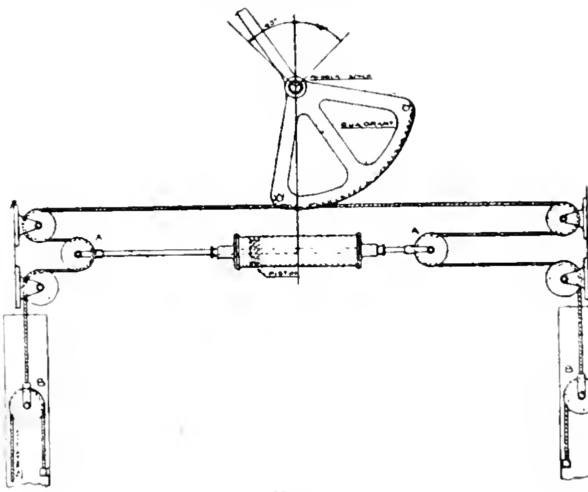


Fig 2

In the event of undue strain being put upon the vessel's rudder, the engine instantly operates as a buffer. The action is just the reverse of that necessary for steering, but accomplishes the same purpose,

that of keeping the rudder exactly where desired. The movement of the rudder forces the piston to travel. The travel of the piston opens the piston valve at the end of the cylinder towards which the piston is travelling. Steam is thus admitted in proportion to the movement of the valve, and by the time the piston has been driven back to the proper position the steam is again automatically shut off. This gear is stated to be so sensitive that the turn of one spoke of the pilot wheel will perceptibly alter the course of the boat, and the action is perfectly noiseless, as the piston and other working parts move slowly, yet the movement of the rudder is quicker with this engine than with indirect connection. The steam cushioning of the rudder is also a great advantage, as it makes the rudder safer from damage in heavy seas or from sudden impact with solid objects, and does away with the necessity of spring-cushioning the quadrant. While under ordinary conditions a rudder operated by the Nash-Century engine remains stiffly in the desired position, its yield in case of collision with the dock or from sudden undue pressure being just enough to ease the shock to the connections, pintles and so forth, hence the wear and tear on these parts is less and there is less danger of breakage.

The new engine is intended as a "steam-only" machine, but where desired, provision may be made for hand-steering also. The practical arrangement for both is shown in the illustration Fig. 2. During steam operation clamps on the hand-wheel cable are set to prevent movement of the latter. If for steam operation, sheaves on the ends of the piston rod are made fast by clamps. In the arrangement shown the cylinder is placed athwartships, which is the usual location. If desired, however, the engine may be placed fore and aft or at an angle to the quadrant. The cylinder may be mounted upon the deck, swung from underneath deck beams, or mounted upon a bulkhead.

The Century Engineering Company, of Ogdensburg, N.Y., U.S.A., are the manufacturers of this novel construction of steering gear.

Messrs. Leonard Chapman & Co., importers and manufacturers, Munton Road, London, S.E., report.—Graphite as imported, according to quality:—

Ceylon L.L. c.i.f. London	£28	10	0	to	£46	10	0	per ton
,, O.L. ,,	16	10	0	to	44	10	0	,,
,, chips ,,	11	10	0	to	32	10	0	,,
,, dust ,,	7	0	0	to	27	0	0	,,
Purified, milled and ground								
Ceylon, 97% to 99% f.o.b.								
London	50	0	0	to	63	0	0	per ton
,, 90% to 91% ,,	40	0	0	to	42	0	0	,,
,, 80% to 81% ,,	30	0	0	to	32	0	0	,,
,, 70% to 71% ,,	27	0	0	to	28	0	0	,,
American large flake, f.o.b.								
London	45	0	0	to	40	0	0	,,
,, small ,,	35	0	0	to	45	0	0	,,
Graphite Jointed Comp. ,,	2	9	0	to	2	12	6	per cwt.
Graphite Paint Paste ,,	2	0	0	to	2	2	0	,,
Graphite Paint ,,	0	4	6	to	0	5	0	per gal

Wholesale lists of tinned goods on application.

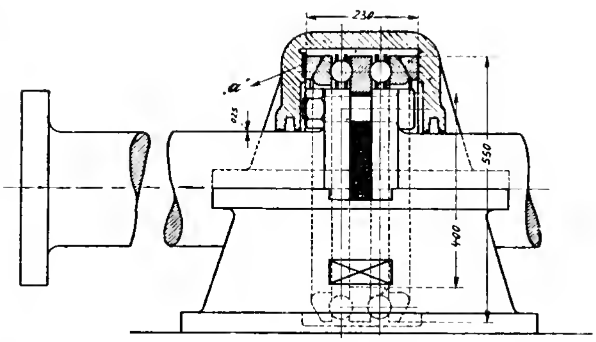
The Institute of Marine Engineers.—The opening meeting of the Institute of Marine Engineers and presentation of awards took place on Monday, the 27th September. Papers on "Water-Hammer," by Mr. Bishop N. King (member), and on "Hydraulic gear for passenger steamers," by Mr. A. M. McAlister (member) were read. Discussion on Mr. McLaren's paper on "The extended uses of electricity on board ship," given in full in this issue, will take place on the 18th of this month.

BALL THRUST BLOCK.

ALTHOUGH the use of anti-friction devices for thrust block or end bearing purposes have been known for many years past, very little development has taken place in this direction for marine work. There is little doubt that one of the reasons for this non-development has been the necessity for a specially constructed shaft to enable the system to be applied.

There is no question as to the advantages that obtain with such devices both as to mechanical efficiency and the cost of lubrication and consequent attention thereto. One of the difficulties encountered in anti-friction end thrust bearings, is the uniform distribution of the load over the whole of the rolling elements employed, in order to avoid as far as possible any risk of local application of total pressure, involving possible crushing of the rolling element or damage to the race on which they run. These considerations particularly apply to the case in which balls are used, owing to the small area of supporting surface of the ball on the race.

We have pleasure in illustrating a novel type of thrust bearing which is readily adaptable to the shaft



of an ordinary marine engine. The illustration shows the upper part in sectional elevation and the lower part in plain elevation. The device is constructed as follows:—The flange coupling of the shaft at one part is unbolted and separated for a distance about equal to the width of one flange and the bolts are removed. The lower part of the frame or block is then placed in position on its bearer and bolted down firmly. Then each bed ring with spherical bearing surfaces is passed down between the flanges, and threaded on to the shaft, one on each side of the flanges. The stationary ball races with spherical bearing surfaces are then passed on to the shaft followed by the ball cages with the balls, and finally the central ring is installed in place and is gripped up tight between the flanges by the coupling bolts. When all is in position the upper part of the block is placed on the lower part, and the whole bolted up together.

It will be recognised that by the provision of the spherical bearings on each side, the balls will themselves automatically adjust the stationary races so that they get an uniform distribution of load. The whole of the moving parts run in an oil bath, therefore attention about once a month only is necessary for the purposes of lubrication.

This device is put on the market under the title of the D.W.F. Thrust Bearing, the sole agents in this country being Messrs. Ludw. Loewe & Co., Ltd., of Farringdon Road, London, E.C.

ON HEAT LOSSES.

From a Correspondent.

(V.)

(*Continued from page* 64).

WHEN laying down high-pressure diagrams to pressure and volume scale for the purpose of calculating actual steam consumption, care should be exercised that the point where compression commences is correctly set out.

When cut-off takes place about or before half-stroke there is very little water present in clearance space when fresh steam is admitted; but with the cut-off at a later period than half-stroke, there is less re-evaporation during expansion, and the exhaust closure also being later, there is always water present in the clearance space when compression begins, and must be allowed for when calculating the total weight of steam used per stroke.

The deleterious effect of the slide valve and ports is made manifest when the temperature lines are drawn on the combined diagram, as in Figs. 7 and 8.

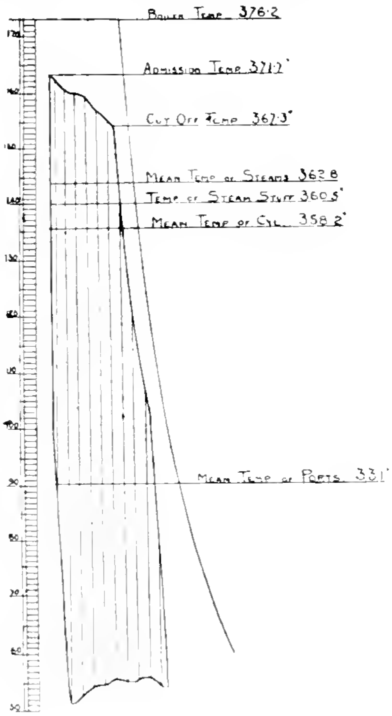


Fig. 7

Referring to Fig. 7. In Figs. 5 and 6, page 65, the mean temperature of the steam at admission was shown to be 371·7°, and that of the ports 331°, and they are drawn opposite their corresponding pressures, together with the other temperatures from which the dryness fraction ·833 was deduced. The net volume of the cylinder up to cut off at ·52 of the stroke, including clearance, is 6·541 cub. ft. At 52 lbs. pressure, immediately after compression begins, the volume is 2·8 cub. ft., and the volume of a pound of steam at that pressure is 6·356 cub. ft.; then 2·8 ÷ 6·356 = ·44 lbs. of steam in clearance. The volume of a pound of steam at admission pressure is 2·53 cub. ft., and 2·53 × ·44 = 1·113 cub. ft. of steam in clearance space at admission. The total volume to be filled with fresh steam up to cut-off is therefore 6·541 — 1·113 = 5·428 cub. ft. Dividing this by the dryness fraction and again by the volume of a pound of steam at admission pressure, we obtain the weight of steam required per stroke, thus $\frac{5·428 \div ·833}{2·53} = 2·575$ lbs. of steam per stroke, and

2·575 × 2 × 80 revs. × 60 min. = 24,720 lbs. per hour and

$\frac{\text{lbs. of steam per hour}}{\text{indicated horse power}} = \frac{24,720}{1,735} = 14·25$ lbs. of steam per I.H.P. per hour.

The dryness fraction being ·833, we have $16\frac{1}{2}$ per cent. of the steam wasted during admission, accompanied by 10 per cent. loss in referred mean pressure by Willan's law, and this agrees very closely with the 35 per cent. loss of B.Th.U. as calculated at page 65.

There are very few triple engines which consume less steam than the above example at ordinary sea speeds, but on the other hand, chiefly owing to faulty design, many consume more, and some a great deal more. Fig. 8 is the high-pressure diagrams from what is probably the most wasteful type of triple marine engine now in service. In this case, owing to the unscientific way in which the live steam is conducted to the cylinder, the temperature at cut-off is actually lower than the mean temperature of the cylinder. Admitted at 391·3°, it is reduced by the valve and ports

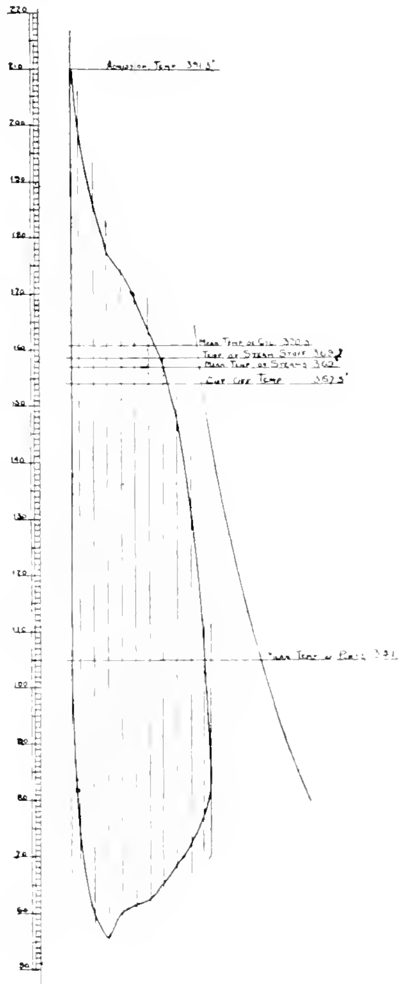


Fig. 8.

to 367·5° at cut off. The mean temperature of the ports being 331°, and that of the steam lines 370·5° [illegible]

$$\frac{367·5° + 370·5°}{2} = 369° \text{ Mean temperature of steam.}$$

$$370·5° - 369° = 1·5° = \text{Fluctuation at surface.}$$

$$\frac{370·5° + 369°}{2} = 369·75 \text{ Temperature of steam at cut-off.}$$

$$\frac{\text{density at } 369·75° = ·3800}{\text{density at } 391·3 = ·4620} = ·823 \text{ Dryness fraction.}$$

The nett volume of cylinder up to cut-off at ·70 of the stroke, including clearance, is 40·43 cub. ft. With the engines running at 114 revs. per min., and cutting off so late as 70 per cent., there is only a fraction of a second during which re-evaporation can take place, and it is seen by the saturation curve that none takes place during expansion, and the amount during exhaust may safely be treated as a negligible quantity.

The volume at 57 lbs. pressure, immediately after compression begins, is 19·50 cub. ft., and the volume of a pound of steam at that pressure is 5·038 cub. ft. The dryness fraction of the steam not having altered during exhaust, the actual weight of steam stuff in clearance when compression begins is greater than is shown by the indicator; and the dryness fraction being known the actual weight is

$$\frac{19{\cdot}50 \div {\cdot}783}{5{\cdot}038} = 4{\cdot}193 \text{ lbs.}$$

The volume of a pound of steam at admission pressure is 2·03 cub. ft. Then $2{\cdot}03 \times 4{\cdot}193 = 8{\cdot}511$ cub. ft. of steam stuff in clearance space at admission pressure. The total volume of cylinder up to cut-off being 40·43 cub. ft. we have $40{\cdot}43 - 8{\cdot}51 = 31{\cdot}92$ cub. ft. to be filled with fresh steam, and the weight of steam per stroke is, $\frac{31{\cdot}92 \div {\cdot}783}{2{\cdot}03} = 20{\cdot}078$ lbs.

and $20{\cdot}078 \times 2 \times 114$ rev. $\times$ 60 min. $= 274{,}667$ lbs. per hour.

$$\frac{\text{lbs. of steam per hour} = 274{,}667}{\text{indicated horse power} = 12{,}024} = 21{\cdot}25 \text{ lbs. of steam per I.H.P. per hour.}$$

In this case, with a dryness fraction of ·783 we have 21¾ per cent. of the steam wasted during admission, and 24½ per cent. loss in referred mean pressure.

These two cases may be taken as representing the best and the worst types of triple marine engines. The abnormal consumption of steam by the large engine is easily accounted for when the slide valve Fig. 9 is examined. Apparently the main object of the designer was to reduce weight, and in order to cut out a short length of pipe, connecting top and bottom exhaust chambers, he converted the slide valve into an exhaust pipe. By so doing he reduces weight by an infinitesimal amount, but increases the coal consumption 30 per cent or so!

For a blunder—in length, in breadth, and in height—this particular blunder is colossal. With the exhaust steam passing through the slide valve, the effect on the entering live steam is precisely the same as if a portion of the main steam pipe had been surrounded by a cold-water jacket.

The enormous waste of heat and power which occurs during admission becomes more pronounced as the initial pressure increases, and is the principal reason why quadruple engines are so little superior to triples. The advantages of the separate steam and exhaust valves are so many, and so great, that it is difficult to understand why the present wasteful methods are tolerated. The last example shows the utter futility of using high-pressure steam without safeguarding it against heat loss. How steam at 391° can be expected to give an adequate return in the shape of work when it is constrained to pass through the same port as the exhaust steam at 300° is beyond comprehension. Is the work and teaching of such men as Watt, Rankine and Kelvin to be set at naught? Surely not. And yet, by neglecting their teaching, we find that a slight alteration in design, and an increase of 21 per cent. in working pressure, results in an increase of steam consumption from 14·25 to 21·25 lbs. per I.H.P. per hour, nearly 50 per cent!

But few shipowners, or others interested in the running of steamers, are aware of the fact that at present the triple marine engine uses quite 30 per cent. more coal than is necessary, and they submit to it with as good grace as they can muster because they have been led to believe that the marine engine as it stands is the very acme of perfection. As regards workmanship this is quite correct, and when the consumption of fuel has been brought under the lowest point attained by high class land engines, then it might be said that the marine engine was one step nearer the perfect state.

Seeing that a slight alteration in design increases the steam consumption from 14·25 to 21·25 lbs., it requires no great effort to imagine another slight alteration which would reduce the consumption from 14·25 to 10 lbs. per I.H.P., and if, peradventure, any shipowner should chance to peruse these lines, he would do well, before placing an order for a new vessel, to have the matters herein set forth thoroughly investigated; as a reduction of 30 per cent. in the coal bill with a corresponding increase in cargo space is not to be despised.

To attain this end separate steam and exhaust valves are required, with or without special gear. The receivers separate from the cylinders so that each can be properly lagged. A reservoir in the uptake in which air drawn from the atmosphere is heated to the temperature of the funnel gases, and forced through tubes in the receivers, and returned to the reservoir to be re-heated and kept in circulation. This ensures a constant supply of dry steam entering the engine, and neutralizes liquefaction in the cylinders, inasmuch as the steam is compelled to pass over heated surfaces in each receiver, and far more power can be obtained from a given weight of steam than is possible with land engines, where live steam is used for this purpose. The tubes in the receivers

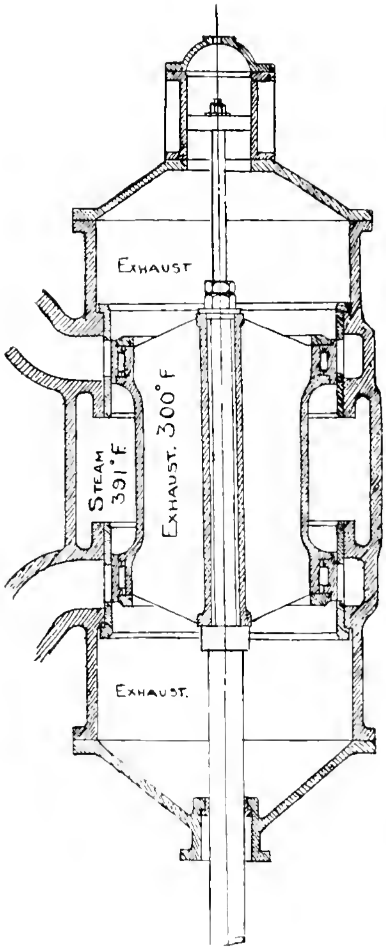


Fig. 9

only being exposed to pressure, the rest of the system can be made lighter, and is safer by far than any superheating plant as now fitted.

(Conclusion).

The Ernest Renan.—The water-tube boilers of the "Ernest Renan" are of the Niclausse type. There are forty-two of them, divided into two groups, each having three funnels. The total grate area is 2080 sq. ft., and total heating surface 84,500 sq. ft. The full working steam pressure is 209 lbs. on the square inch. There are 14,520 boiler tubes, each having a length of 7 ft. 6 in., the lower tubes having an interior diameter of $2\frac{13}{16}$ in. and the upper tubes $3\frac{1}{16}$ in. The power developed, *viz.:* 37,500 h.p. at a speed of 25·5 demonstrates the value of the Niclausse engine and vaporisers.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

Portsmouth Dockyard.

By the time these lines are published the battleship *Neptune* will have been launched by the Duchess of Albany, the ceremony, as already stated, having been fixed for September 30th. At the time of writing, very satisfactory progress is being made with the building of the vessel, whose launching weight will be about 7,500 tons. The *Neptune*, which was laid down on January 19th, is a vessel of 20,250 tons, her main armament being ten 12-inch guns and her anti-torpedo battery, comprising twenty 4-inch quick firers. She should be completed and ready for sea by January, 1911, by which time Great Britain will have a fleet of eight *Dreadnoughts* in commission. The plans have been received for the new ship which is to be laid down after the launching of the *Neptune*. They are for a battleship, and not for an armoured cruiser, as was at first anticipated. With regard to the *St. Vincent*, which is completing, it is not likely that her trials will be carried out until about the end of the year. The turbine destroyer *Velox*, which is used as a tender to the torpedo school ship *Vernon* for wireless instruction, is to have her boilers retubed. Although nominally a 30-knot boat, she has never yet reached 24 knots. The Admiralty are understood to be contemplating a change in the arrangements for the instruction of stoker recruits. For some years these men on joining have been sent to the *Nelson*, on which they have undergone various phases of their instruction, with the exception of sea training, which was provided in torpedo gunboats and other small craft. It is now proposed to do away with the vessel, as she has been found to be too small, and is not a healthy ship. The establishment is to be transferred to the battleship *Renown*, and the *Nelson* will be sold. Second-class stokers will be transferred to the Naval Barracks for a course of physical training, and parties will receive their practical engineer training, extending over about six weeks, in the *Renown*, which will have a smaller vessel attached. The vessel's heavy guns will be retained and her secondary armament will also be kept ready, so that she will still be of use as a fighting ship. A discovery was recently made which at first caused some consternation, it having been stated that explosives had been found among some coal which had been taken on board the *Duke of Edinburgh* from a collier. It was officially stated, however, that the cartridges were not regarded as dangerous, examination proving them to have been detonators used for firing charges, and in the circumstances no inquiry was held. A few days later a similar discovery was made among the bunker coal of the scout *Forward* while she was carrying out exercises, and the ship returned to Portland Roads, where the whole of the coal was discharged into lighters. The *Forward* had coaled from the same collier. Such things may not be dangerous, but it is very inconvenient to have to examine all the coal in a vessel. Admiral of the Fleet Sir Edward Seymour, who has been appointed the British representative at the Hudson-Fulton celebrations, hoisted his flag in the cruiser *Inflexible* here on September 1st, and left on the 10th for New York. Three vessels of the Fifth Cruiser Squadron, under Rear-Admiral Hamilton, left a few days earlier. It is understood that on her homeward journey the *Inflexible* will endeavour to beat the *Indomitable's* record from Canada when she had the Prince of Wales on board. The latter vessel's highest speed on that occasion was 26·4 knots, her average from land to land being 25·13 knots. The Danish submarine *Havlen*, which arrived from Spezia, where she was built, on September 9th, made a somewhat remarkable voyage for that class of vessel, having had no convoy, and she proceeded to Denmark without one. Engineer-Commander Gibbs, who had been serving for the past four and a half years at this yard in charge of the torpedo depot, has just retired with the rank of engineer captain, after over twenty-nine years' service. Captain Gibbs served as assistant engineer of the *Orontes* during the Egyptian War of 1882.

Devonport Dockyard.

It has now been officially announced that the cruiser *Indefatigable*, which was laid down on February 23rd, is to be launched on October 28th, but it is not yet known by whom the ceremony will be performed. Work on the vessel is in a very forward state. From certain details which have become known of the vessel to be laid down on the slip now occupied by the *Indefatigable*, it appears that the new vessel will be a "super-*Invincible*." She will possess a speed of close on 30 knots and have a length of about 600 feet, for which purpose the slip is to be lengthened 80 feet. It is possible that her displacement will not fall far short of 26,000 tons, the same as the ship the Americans are about to lay down. Her main armament will consist of eight 13·5-inch guns, and she will have an improved anti-torpedo armament and increased armour protection. The vessel will have only one mast, and this will be of an improved design, with greater shell-resisting power. The progress of the battleship *Collingwood* continues to be very satisfactory, especially as regards the machinery and boilers. An innovation is being made in connection with the navigating bridge, which is to be entirely of metal, instead of wood and steel as hitherto. A fire was discovered about midnight on September 9th in one of the coal bunkers, and upon examination it was found that a quantity of wood was burning. Owing to the large amount of smoke it was some time before the seat of the fire could be located, but eventually the bunker was flooded and little damage was done. With regard to repair work, the *Leviathan*, flagship of the Fourth Cruiser Squadron, is to be modernized, and the work is to be completed by the second week of November. The battleship *Hannibal*, too, is in hand, having sustained damage by striking an unchartered rock on leaving Babbacombe Bay. On being docked it was found that her hull had been indented to the extent of 20 or 30 feet below the bilge well on the port side. At the time of the accident the *Hannibal* is said to have been in 40 feet of water, which is ample draught. It is expected that the repairs will occupy until nearly the end of October. Engineer-Commander Flood, who had been serving in the *Hannibal* since the end of last year, has just retired with the rank of engineer-captain, after over twenty-eight years' service. The destroyer *Gipsy* met with a mishap on September 10th, when proceeding to Belfast for repairs to her boilers, having gone ashore in a fog near Grey Point, Belfast Lough. The vessel was refloated two hours later and dry docked at Messrs. Harland and Wolff's, who carried out temporary repairs so that she could resume her ordinary duties. Permanent repairs will be carried out when the *Gipsy* comes in hand in the ordinary course, which will probably be in December. It appears that two holes were made in the bottom and the bottom plating was indented between the frames, while both propellers were damaged and one propeller shaft was bent. The work in connection with the long refit of the cruiser *Hogue* is completed. The vessel is to be transferred to the Nore Division of the Home Fleet, and she will leave here about the middle of November. The sloop *Espiegle*, which is doing duty with the Naval College at Dartmouth, is to be taken in hand for a large refit to prepare her for service on the East Indies Station, when she is relieved in November by the cruiser *Pomone*, now refitting at Chatham. We have had a visit from the Brazilian cruiser *Benjamin Constant* which had on board part of the crew for the Brazilian battleship building at Messrs. Armstrong's, on the Tyne. Considerable interest was manifested in the vessel which with her lofty spars and white hull presented a most pleasing picture, quite different from most warships. An interesting ceremony took place on September 13th, when a window in memory of the late Lady Beaumont which has been placed in the Dockyard Chapel by Admiral Sir Lewis Beaumont formerly commander-in-chief at this port, was dedicated.

Chatham Dockyard.

Once more the Chatham and Gillingham corporations are taking steps to urge upon the Admiralty the desirability of laying down a large ship here and their Lordships are to be requested to receive another deputation. The only new construction now in hand is the submarines the two tugs for Portsmouth and Devonport having been launched. There is however no shortness of work. The engineering department is very busy, and it does not appear as if there will be

any slackness just yet. An order has recently been received for nine tubes for the destroyers which are to be built for the Australian Government, and instructions have also been received for the construction of the engines for two more submarines of the "D" class. The engines we have built for submarines have given great satisfaction, and the Admiralty have expressed their appreciation of the manner in which the work has been done. Submarine "C. 17," which was damaged in collision with another submarine in the North Sea on the night of July 14th, when submarine "C. 11" foundered, has completed her refit. She proceeded to Portsmouth on September 16th to rejoin the flotilla at that port, under convoy of the cruiser *Charybdis*. The latter vessel afterwards went on to Devonport to embark classes of mechanicians from the depot ship *Indus* for an instructional cruise to Kingstown, returning to Plymouth on October 1st, and leaving again on the 4th with fresh classes on a cruise to the Humber. The battleship *Agamemnon*, which came in for docking after grounding on the Longsands, was undocked on September 1st, and afterwards proceeded to the Longsands to resume her firing exercises. The vessel was undamaged, but a few seams in her plating had to be recaulked. The cruiser *Blenheim*, which was also docked in consequence of stranding at the entrance to Harwich Harbour, was found to be uninjured, and left here the same day. The battleship *Venerable*, having been refitted at a cost of over £70,000, has been selected for service in the First Division of the Home Fleet in place of the *Irresistible*. The cruiser *Andromache* has been commissioned for service in the Third Division of the Home Fleet at the Nore as a minelayer, for which she has been specially fitted at a cost of over £22,000. There are now five obsolete cruisers in commission as minelayers. On November 1st the cruiser *Naiad*, now lying in the River Stour, is to be taken in hand to be prepared for service as a minelayer, for which purpose a sum of £17,000 is to be expended. Later on her sister cruiser, the *Intrepid*, will be similarly fitted. The refit of the cruiser *Pomone* is to be completed in time to admit of her relieving the sloop *Espiegle* at Dartmouth in November. The cruiser *Euryalus* is to pay off at this port on December 1st, when she will be taken in hand for a refit, for which £51,146 is provided. With reference to the repair of the cruiser *Sappho*, the Admiralty have conveyed to Mr. Bate, constructor, the expression of their Lordships' high appreciation of the zeal and judgment shown by him in connection with the rapid repair of the vessel. Their Lordships also expressed their satisfaction with the services rendered by Mr. Huxham, foreman of the yard, and Mr. Gladwell, inspector of shipwrights. In connection with the matter three shipwrights have been awarded £3 each and five £2 each, while four skilled labourers were each granted £1 10s.

Sheerness Dockyard.

When information arrived that the battleship *Agamemnon* had stranded on the firing grounds near the Longsands, three tugs immediately left to render assistance. Only the services of one tug were required, and she had out a hawser which was attached to the stern of the battleship, which was floated off early next morning, apparently uninjured. The divers' examination of the bottom of the vessel did not reveal any damage, but it was decided to dry dock her, and the *Agamemnon* proceeded to Chatham for that purpose. The destroyer *Ghurka*, which had been in dock, having been undocked, was placed alongside the dockyard wall to raise steam before going to her buoy. In backing astern two of her propellers caught the launching rails of the torpedo station, one propeller having a blade bent and one a blade knocked off. She had to be redocked for spare propellers to be fitted, and she has now joined the First Destroyer Flotilla. The *Ribble* completed her refit on August 30th, as did the *Boyne* two days later, and both have proceeded to the North of Scotland to rejoin the First Flotilla. The *Cossack* was dry docked on September 1st for a refit, and she will also have her armament strengthened by the addition of two 12-pounder 12-cwt. quick firing guns. She will then carry five guns of this calibre. The destroyers *Garry* and *Wear* and the ocean-going destroyers *Amazon* and *Saracen* also came in for docking, but they have now gone to sea. At the time of writing the *Erne* is here in addition to the *Cossack*. The former vessel will join the Second Flotilla, her place in the First Flotilla having been taken by the ocean-going destroyer *Afridi*. The battleship *Albion*, late of the Atlantic Fleet, has been recommissioned for service as parent ship of a second group of special service ships in the Fourth Division of the Home Fleet at the Nore. She will be joined shortly by the battleships *Ocean* and *Canopus*, which are to return home from the Mediterranean when relieved by the *Russell* and *Cornwallis*, transferred from the Atlantic Fleet, in which they are being relieved by vessels of the *Formidable* class. A canister of blasting powder was recently found in a cargo of Welsh coal which was being unloaded from a collier into the *Jumna*, floating coal depot, moored off Port Victoria. A search was made, but no other explosive was discovered. A similar find was made at Portsmouth and it was at first thought that an Anarchist plot was on foot. It was officially decided on September 17th to abandon the salvage of Submarine "C. 11," owing to the impracticability of raising the vessel from the bed of shifting sand on which she rests. Except when prevented by rough weather, salvage operations had been carried on for nine weeks, and although the salvage party had known for a fortnight that they were working on an impossible task, everything possible was done before the decision to abandon operations was arrived at. The only result of the work has been the recovery of one body. The forecast last month as to the promotion of Captain Johnston Stewart to flag rank was not far wrong, for the Captain-Superintendent was promoted on September 8th. It is understood that his promotion will not involve the relinquishment of his post for some time yet. It is interesting to note that two engine-fitter apprentices at this yard, Messrs. Pinch and Morgan, have each been awarded a Whitworth exhibition of the value of £50.

Pembroke Dockyard.

The most interesting event here of late was the visit on August 27th of Mr. McKenna, who arrived in the Admiralty yacht *Enchantress*, accompanied by Sir Charles Ottley (the Secretary of the Committee of Imperial Defence), and Mr. J. W. Benn, M.P., and Mr. Baddeley, private secretaries to the First Lord. Captain-Superintendent Mundy and other officials received the party on landing and conducted them through the yard. Deputations of all classes were then received, Mr. J. Jenkins, M.P., appearing as one of the representatives of the shipwrights and skilled labourers. During the inspection several sites for a new repairing base for submarines were examined and surveyors are to be sent to see the sites and report on their suitability. Pembroke, it is considered, would form an admirable place for the establishment of a submarine base, though the provision of a new basin would be necessary for the purpose. A considerable sum will be required to equip the yard for the new duties to be assigned to it and the money is to be provided in next year's estimates. It has been announced that the cruiser *Blanche* is to be launched on October 27th. At the time of writing, however, she appears to be in a somewhat backward condition, but a large number of extra men have been put on, so there is no doubt but that she will be ready in time. The anxiety to launch the vessel is accounted for by a desire to lay down the *Blonde*, on which £20,000 is to be spent in labour before April. Preparations are well in hand for laying down the new vessel. Up to the present the date of the steam trials of the *Bellona* has not been announced, but the water tests of the boilers, turbines and steam pipes have been made. The refit of the destroyer *Osprey* is proceeding satisfactorily. The Captain-Superintendent has received a most complimentary letter from the Secretary to the Admiralty with reference to the cost of building and completing the cruiser *Defence*. "In view of the saving which was effected on the estimate approved for Admiralty work," states the Secretary, "I am to convey to you an expression of their Lordships' appreciation of this satisfactory result, and to request that you will inform the dockyard officials concerned." The electrical workshop here is to be extended, and the work will be carried out under the assistant civil engineer in charge of the works department.

Messrs. Holzapfel's, Ltd., have sent us a list of vessels, British and foreign, coated with their compositions, during the period January-June, 1909, representing a total of 7,011,807 tons gross register. In addition large parcels of composition have been exported for use abroad. The *Mauretania* has Holzapfel's international composition on her bottom.

THE HUDSON-FULTON COMMEMORATION.

THE two events now being celebrated in New York have a special interest to Englishmen. The celebrations commenced on 25th of September and continue until the 9th of this month, and all the principal sea powers are represented. This country has sent three vessels of the fifth cruiser squadron, *viz.*, the *Drake*, the *Duke of Edinburgh* and the *Argyle* under Rear-Admiral Hamilton, also the cruiser *Inflexible*, on which the British representative, Admiral of the Fleet Sir Edward Seymour, has hoisted his flag.

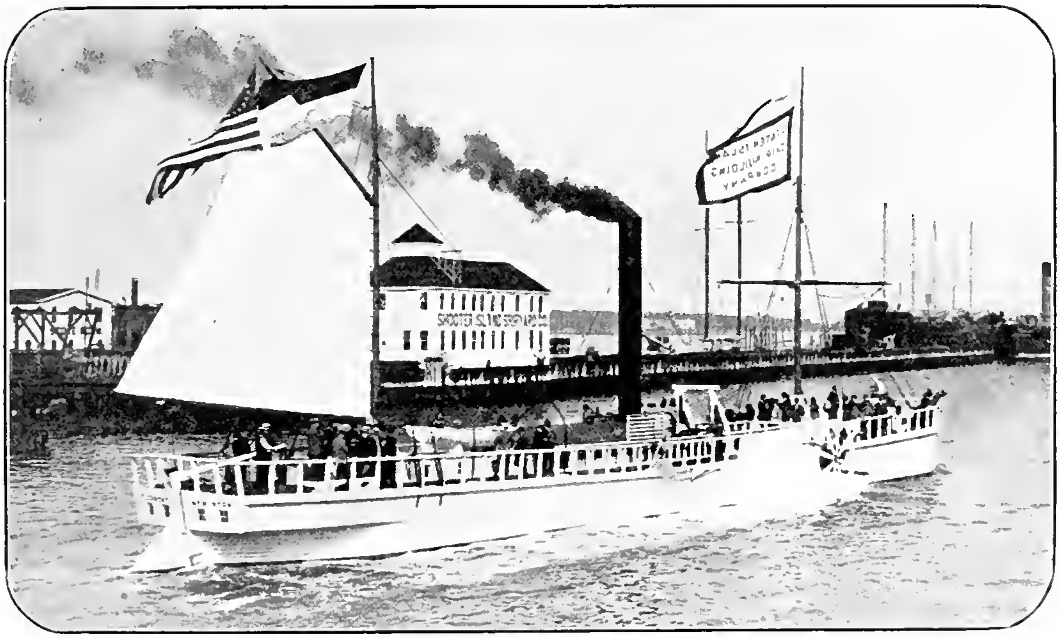
Henry Hudson, the famous English navigator and explorer, made four voyages to discover the N.E. and N.W. passages, first for the Muscovy Company in the little *Hopewell* of 60 tons, and afterwards for the Dutch East India Company. His third voyage was undertaken for the latter company, and he left Texel in April, 1609, with a crew of eighteen men in the *Half Moon* of 80 tons burden. In September of the same year he first explored and travelled 150 miles up what is now known as the Hudson River. During his fourth voyage in the *Discoverie* of 70 tons burden, undertaken in 1610, he discovered the Bay now called by his name. This proved to be his last voyage, part of his crew mutinied and he with eight others were sent adrift in a small boat and never seen again.

A model of the *Half Moon* in which he first explored the Hudson River has been built in Holland, sent to America on a steamer and takes part in the pageant.

Robert Fulton, born in 1765, at Little Britain, Pennsylvania, displayed in early life a taste for painting, and intending to adopt it as a profession, he came to England to study under Benjamin West. He, however, devoted much of his time to mechanical matters, and during a visit to Birmingham, he made the acquaintance of the celebrated James Watt. Fulton now gave his entire attention to mechanical engineering and conceived the idea of the propulsion of ships by steam. About this time he went to Paris, where he made attempts at steam propulsion on the Seine. In 1806 he returned to the States, and supplied with the necessary funds by his friend Robert Livingston, Fulton proved that steam could be applied successfully to the propulsion of ships. His first vessel, the *Clermont*, launched in 1807, and propelled by steam power, travelled from New York to Albany, a distance of 150 miles, in thirty-two hours, or at the rate of nearly five miles per hour. She was 150 ft. long, 13 ft. beam and drew 2 ft. of water. Her bottom was quite flat, the paddle wheels were 15 ft. in diameter and uncovered. The engine was built for Fulton and to his design by Boulton & Watt, at the Soho Works, Birmingham, in 1804-1805, and thus was steam navigation brought to be a commercial success for the first time.

His second large boat on the Hudson was the *Car of Neptune* and he afterwards built other steamers, among them a frigate which bore his name. His reputation had now become established, but at about this period his patent for steam vessels was, to a certain extent, successfully disputed. He died in 1815.

On July 10th, this year, the memory of Fulton was honoured in a most fitting manner, a replica of his first American steamboat being launched into the waters of New York harbour, and appropriately christened by Mrs. Arthur Taylor Sutcliffe, a great grand-daughter of Fulton's. The new *Clermont* has been built after careful examination of all information available on the subject to ensure accuracy in the details of construction, and a reproduction of the original engine built by Boulton & Watt in 1804-1805 has also been made.



The *Clermont*

We have pleasure in giving an illustration of the new *Clermont* as completed, from which will be seen the canal-boat method of steering and the uncovered paddle wheels. An interesting feature is that included in her equipment is the original bell used on the old boat for announcing her approach to the various towns along the river. The bell is in a perfect state of preservation. She also carries the anchor used on the first *Clermont*.

Another boat taking part in the celebration is the *Norwich*, the oldest existing steamer in the world, having been built in 1836, by the firm of Lawrence & Sneden, New York. She is even now in active service and the original engine placed in her in 1836 is still used and is the last one of its type. The *Norwich* is 175 ft. in length, 25 ft. beam and of 256 tons gross. The appearance of the *Half Moon*, *Clermont* and the *Norwich* no doubt adds greatly to the interesting character of the pageant, and the contrast which they must present to the modern ships present cannot fail to be most striking.

ENGINEERING DAY AT THE IMPERIAL INTERNATIONAL EXHIBITION.

On September 4th the Congress Hall at the Shepherd's Bush Exhibition was dedicated to the service of engineering questions, and several interesting and valuable papers were read. Time did not admit of discussion upon the subjects brought before the audiences which assembled, but these will follow later at more convenient seasons to suit the various interests involved. The first paper was read by Mr. A. Steiger on "Water power and turbines," illustrated by wall diagrams. It was urged that the water power available for driving machinery in Britain is not utilized to the extent it might and certainly should be, and with this we quite agree; our advocacy on this subject has been on the same lines as Mr. Steiger. The various designs of turbines to meet the different requirements of machinery and the flow of water from the source were dealt with to explain the form of blade most effective in each case for economy in working. The importance of carefully considering local conditions in designing and planning installations of machinery was emphasized as on these might depend much of the success in working costs and giving satisfactory results along with the desired constant efficiency.

The next paper was on "The extended uses of electricity on board ship," by Mr. John MacLaren, which we reproduce fully. This paper was copiously illustrated by lantern slides showing gas engines, dynamos with various adaptations, and appliances suited for marine service. A paper on the treatment of marine boilers on long voyages was then read by Mr. H. Ruck-Keene. The author first proceeded to set forth the causes leading to failures due to improper management of boilers. The first cited being shortness of water, several hints were given as to the discipline of the stokehold and the manipulation of the gauge connections; cases had arisen where a cock had been inadvertently closed, or where after overhaul in port it had been left closed, thus showing false water, undiscovered until firebox or furnace had been damaged. In times of stress or in heavy weather with the ship rolling the water had been allowed to get so low as to leave the firebox crowns bare, with the result of overheating and damage to the exposed plates. The bursting of tubes sometimes led to loss of water, but the defects could be readily remedied by the tube stoppers carried for dealing with such defects. The author went on to say: "It will be generally accepted that the most frequent causes of breakdown of boilers at sea are either the collapsing or distortion of the furnaces, or the cracking of the furnace plates. The cause of furnaces becoming distorted is not always easily determined. But in view of the exhaustive tests which have been made from time to time, showing that the hydraulic pressure necessary to collapse the various types of furnaces is many times the working pressure, there is no doubt that the distortion or collapsing of a furnace, provided the boiler is not being worked at more than its proper pressure, must be due to the steel plate of the furnace becoming softened, and this can only happen through it becoming overheated. Further, it is impossible to account for the small cracks which too frequently occur in the furnaces without coming to the conclusion that they also are due to considerable overheating of the plates. This overheating of a furnace, worked under normal conditions of combustion, can only be due to some resistance to the transfer of heat through the plate, owing to some substance, such as scale, greasy matter, or other dirt, being deposited on the furnace crown and preventing the free access of the water to the plate. When a thick coating of scale or greasy deposit is found on a furnace, after it has collapsed or has become distorted, the cause of this trouble is at once apparent. An analysis, or even an inspection of the scale, will also show the probable cause of the deposit. If it has been caused by the continued use of small quantities of sea water in the boiler, especially it accompanied by much blowing out, the incrustation will be a hard crystalline scale mostly composed of calcic sulphate. Provided the density of the water does not exceed $\frac{7}{32}$, common salt—sodic chloride—which forms the greatest part of the salts in solution in sea water, will not separate out, but if the density is allowed to reach this latter figure, the sodic chloride will commence to crystallize out, and the scale then formed will mostly consist of this substance. In one case of collapsed furnaces which occurred a few years ago, the deposit on the two furnace crowns of a boiler, which had been in continuous use for several weeks, was $1\frac{3}{4}$ in. thick, and was composed almost entirely of sodic chloride; there was also a deposit on the lower part of the shell of the same substance 1 in. thick. The density of the water remaining in the boiler in this case was found to be $\frac{7}{32}$. The furnace crowns had come down on both sides of the centre line, forming deep pockets which touched the fire bars, fortunately without fracturing the furnace plating. Curiously enough, in this case the incrustation which had formed on each furnace remained as an arch, in the form of the original shape of the furnace." The uses of the hydrometer and of Pig. NO_3 test were commented upon, also the prevention of corrosion and the exclusion of air, the use of zinc and, as far as possible, the avoidance of salt water for filling the boilers or supplementing them, and the absolutely preferential use of fresh water was strongly advocated. The risk attached to the introduction of oils of any kind with the feed water was illustrated from experiments and actual experiences, the auxiliaries being pointed out as the most frequent sources of oil reaching the condenser, thence to the feed. The classes of oils were remarked upon and their peculiarities, with special reference to the hydrocarbon oils. In summarizing the views of those who have a systematic way of treating the boilers to preserve them in good condition the following were specially noted. The insides should be kept clean, and the boilers filled and fed with fresh water. Zinc on studs should be fitted in metallic contact to the plates. Salt water, air and oil should be excluded as far as possible. Steam should be raised slowly and the heat gradually and uniformly applied to the heating surfaces; the boilers should be cooled down gradually when finished with on arrival in port.

A paper on "Large Gas Engines" was then read by Mr. Percy R. Allen, and illustrated by slides. It stated that the gas engine for commercial use may be dated from 1875, when Dr. Nicholas Otto designed his first engine, and later joined with a partner to form a manufacturing firm which developed into the well-known Gas-Motorem Fabrik Deutsch. To the class of engines constructed on the system adopted by this firm the name of the Otto cycle is given. The Otto cycle consists of four strokes, beginning with the suction stroke to draw in the mixture of air and gas; this on the following stroke is compressed, at the beginning of the third stroke the mixture is fired; the pressure then rises to about double the compression stroke; during this stroke expansion takes place and motion is imparted to the crank. During the fourth stroke the products of combustion are driven out by the return of the piston, the cycle is now completed and the engine is ready to make another suction stroke. This arrangement only permits of one working stroke being obtained during two revolutions of the crank. The construction of all these single-action Otto engines is very much the same. There is an open-ended trunk working in a water-jacketed cylinder, the connecting rod is attached to the crank pin at one end and a gudgeon pin at the other. The cylinder is made in two parts, with an inner liner distinct from the outer casing forming the water jacket. The valves to control the admission of the mixture and the discharge of the exhaust are placed in a separate head, the exhaust valve being generally underneath and directly below the inlet valve. These valves are worked off a lay shaft, geared to revolve at half the speed of the crank shaft. Ignition of the mixture is now almost always effected electrically, although other means, especially hot tubes, have been largely employed, and are still used on small engines. Attention should be given to the construction of the single-acting Otto cycle engine, as it can then be more easily understood how the design of the cylinder had to be altered when an engine had to be constructed to work double acting. Between 1875 and 1895 no great change was made in the general design, but in 1894 the late H. B. Thwaite demonstrated that by taking blast furnace gas after being properly cleaned and cooled, engines could be driven by it with a fairly high compression. The result was that a large field was opened up for the profitable employment of large internal combustion engines, both in Britain and on the Continent. The Korting cycle engine has a long cylinder with a series of exhaust ports in the middle, fitted with a deep piston, which only covers these ports for a short period at each end of the stroke. There are two

pumps, one supplies gas and the other air; they are worked by a crank approximately at right angles to the main crank, and deliver gas and air at a few pounds pressure through separate channels, which join just above the inlet valves, of which there is one at each end of the cylinder. The operation starts with the explosion stroke; as the piston moves away from the cylinder head, the pressure falls in the usual way until the ports begin to uncover, when it falls rapidly to atmospheric pressure. If the air and gas pumps delivered the same volume at equal pressure, the moment the inlet valve opened the mixture would begin to flow into the cylinder, and any scavenging necessary would be done with combustible mixture, but the air pump is so arranged that while the inlet valve has been shut, it has been backing the gas up in one of the passages so that the first flow into the cylinder is pure air, which acts as a buffer driving out the products of combustion at the centre while the mixture is coming in behind. Directly the inlet valve is shut, and the exhaust ports closed, the further movement of the piston on the return stroke begins to compress the charges ready for firing. As far as impulses go, a single-acting engine of this sort is the same as a single-acting steam engine. A Korting double-acting engine has two impulses every revolution, as an ordinary steam engine. In the Oechelhauser cycle, instead of having the exhaust ports in the centre of the cylinder the ring of holes is at one end, and the gas and air ports in separate rings at the other end. Two pistons are fitted, connected to the opposite webs of a three-throw crank, and in the course of one revolution alternately approach and recede from one another. When they are nearest to each other in mid-cylinder the charge of mixture is compressed ready for firing, and the cranks are approximately on dead centre. When ignition takes place, the pistons go in opposite directions, so that at the end of the explosion stroke the exhaust ports are open at one end, and the gas and air inlets at the other. The air inlets are nearer the centre of the cylinder than the gas, and the incoming air tends to sweep out the products of combustion and interpose a barrier of pure air between the exhaust ports and the supply of mixture. The air and gas are supplied by means of two independent pumps or by a double-acting pump worked off the back crosshead, or by an independent crank. The internal combustion engine differs from the steam engine in that a certain amount of heat is deliberately wasted, as the cylinders and connections require to be water cooled, otherwise the cumulative effect of successive explosions would raise the temperature to a very high degree. It has frequently been proposed to utilize the heat in the cylinder jackets for raising steam to assist the output of the engine. It is open to consideration whether in a large installation it might be advisable to fit a low-pressure turbine to better utilize the heat, which at present is used otherwise. There were other details treated of in this interesting paper, which, however, cannot be enlarged upon here. The closing papers by the Messrs. Ablett were on Drawing and Sketching, the first one treated of perspective drawing and explained the principles on which perspective is based, the difficulties to be met with in studying the subject, and how these can be overcome. A method was also shown which the student or draughtsman could adopt to enable him to accustom himself to a line of action leading to a thorough grasp of perspective drawing. The second paper dealt with "Snap-shot drawing for engineers and architects," and after defining that drawing is the process of producing certain markings of a descriptive nature to serve as records and convey information in connection with pictorial, mathematical, diagrammatic and decorative work, proceeded to analyse drawing with a view to induce thought on the subject, and a study of the fundamental principles involved. The Royal Drawing Society desire to enlist the sympathy and help of all engineers to promote the study of drawing and sketching correctly. A number of lantern views were shown to illustrate the points in the papers.

A reception was held by the Lord Mayor of London, and in the course of the evening visits were paid to the machinery sections of the exhibition.

A dinner was held in the Garden Club at night, when there was a large gathering of engineers and their friends to celebrate the close of a day which is worthy of remembrance.

Messrs. Suter Hartman & Rahtjen send us a list of vessels, representing a total tonnage of 3,796,882, that have been supplied with their composition during the last three months.

International Correspondence Schools.—The dinner in connection with the International Correspondence Schools was held in the Hotel Cecil on September 18th, and was presided over by Sir Thos. Brooke-Hitching in the unavoidable absence of Lord Montagu of Beaulieu. The building used by the Schools in London is in Kingsway and comprises an extensive range of offices, which we may have occasion to refer to later when opportunity serves. The assembly of representative students, from different parts of the kingdom and in many walks of life at the dinner was a revelation even to those who have been watching with interest the growth of the Schools, and who have been keenly alive to the enterprise and business capacity in the management. Another proof of those elements which go towards success was evidenced in the details which brought over 400 students together on invitation of the committee of management, by whom their expenses were paid and a programme of visits arranged for their special benefit and educational advantage. After the loyal toast was submitted and heartily responded to, the Chairman proposed "The International Correspondence Schools," pointing out the disadvantages under which the average young man or wage-earner laboured in carrying on his work on account of lack of special information and education of a technical character to enable him to elevate himself above his immediate surroundings; he emphasized the fact that not only did the Correspondence Schools supply a manifest want in the educational system, but enabled students—and these were not confined to youths only, the average age being from twenty-six to twenty-seven—to qualify themselves for better positions, and many had, by a course of study, attained to good positions, acknowledging their indebtedness to the schools for their success. Mr. E. A. Seitz, managing director, who responded, received an ovation which proved the sympathetic loyalty of the students. He referred to the small beginning of the Correspondence Schools, their progress since the days of foundation by Mr. T. J. Foster, and the good work which had been accomplished all over the world and in almost every rank of life from the miner to the prince. Theirs was not a philanthropic institution but a business concern, which depended for its life and growth on principles which appealed to the instincts of all who desired to better their condition, by self-help; it was the aim of the management to obtain and supply to the students the very best information and guidance in respect to every subject they undertook to teach, and to advise and help them on the way. The next toast was also proposed by the Chairman, "Education for the wage-earner," and responded to by Mr. Dennis Hird, M.A., Oxford, who strongly advocated the systematic spread of useful technical education among the wage-earners. It was said that present-day elementary education, if not an utter failure, fell far short of what it ought to be, as it left the youths on their entrance upon the threshold of life unfitted to take up any business in which they had to earn their livelihood, by reason of a want in their early training. That want the Correspondence Schools attempted to supply and succeeded. Education was a power for good in the land. Mr. L. A. Atherley Jones, K.C., M.P., in an excellent speech full of contemplative thought, proposed "The I.C.S. students at home and abroad," endorsing the view that the elementary education imparted under the Act throughout the country was lacking in many respects, and failed to impart that education and mental training which was necessary to keep the nation in the front rank. He indicated in a few terse words that the sectarian elements and jealousies at work amongst the educationalists were positive causes against true progress. Oral teaching to large classes was not calculated to give good average results, and he inclined to think that the system of teaching the individual student by correspondence was a good one. Mr. W. G. Wilson, a student, responded, and testified to the good he had received from the correspondence tuition in connection with his work in the textile industry. "The Guests," proposed by Mr. O. L. Odell, secretary, was responded to by Col. S. S. Long (Woolwich Arsenal), who gave his opinion on the advantages gained by soldiers under his jurisdiction from the opportunities afforded them by the Schools. Mr. J. M. Macdonald (Messrs. S. Pearson & Son) also responded in similar terms, commenting upon the value of such classes, not only to the workers or wage-earners, but also to the employers, in giving them more intelligent men.

OBITUARY.

Anderson Rodger.—With regret we have to place on record the death, on 10th Sept., at Port Glasgow, of Mr. Anderson Rodger, of Messrs. A. Rodger & Co., shipbuilders and engineers, Port Glasgow and Govan. Deceased, who was in his sixty-eighth year, was a native of Port Glasgow. About thirty-four years ago, when the well-known shipbuilding concern of Russell and Co. was started in Port Glasgow, the firm was joined by Mr. Rodger. At first they had only a small yard in the east end of the town with accommodation to build three ships of average carrying capacity. The business of the firm grew rapidly, and some years later, having meantime acquired by lease the Port Glasgow Graving Dock, they took over the shipyard at Greenock, formerly owned by Mr. J. E. Scott, and now occupied by the Greenock and Grangemouth Dockyard Co. In course of time business expansion necessitated greater outlet, and about 1874 the firm acquired the site at Kingston, half-way between Port Glasgow and Greenock. In the organization of the larger works Mr. Rodger and his partner, Mr. Russell, were ably assisted by the late Mr. W. T. Lithgow, who from being chief draughtsman was then taken into full partnership. Operations were for a time continued in the east yard, as also for a longer period in the Greenock yard, where steam vessels, more than sailing ships, were the product. Sailing ships were long the staple production at Port Glasgow and Kingston, a large proportion of the output being for French and other Continental owners. On several occasions the largest ships of their time were launched from the Kingston yard, and not only during the period when work was carried on in three yards, but later when operations were confined to Kingston, the firm of Russell & Co. occupied premier position in the annual returns of tonnage output. In 1874, on the retirement of Mr. Joseph Russell, the east end yard was taken over by Mr. Rodger, while Mr. Lithgow remained sole partner at Kingston until his death in June of last year. Of the three partners Mr. Russell alone now survives. Under the designation of Messrs. A. Rodger & Co., and with Mr. James H. Hutcheson as partner, a successful shipbuilding business has been since carried on in the East Bay Yard, Port Glasgow, while some years ago also Mr. Rodger acquired and re-established a marine engineering business in Helen Street, Govan, with Mr. E. Hall-Brown as managing co-partner. Although a member of the Institution of Engineers and Shipbuilders in Scotland, and warmly interested in technical and commercial questions affecting the development of the town industries, the deceased never very actively participated in professional movements. He took a keen and generous interest in the affairs of his native town and was for a time closely identified with public work as head of the Municipality, having been elected Provost of the Burgh in November, 1898. Apart from municipal work Mr. Rodger was active in promoting the welfare of the community, and local benevolent institutions benefited from his generosity. Himself unhappily a sufferer from eye trouble, he was ever sympathetic towards those similarly afflicted, and at his expense was built and equipped a fine eye infirmary in Greenock. He is survived by his wife and family of five—two sons and three daughters.

John Thom.—The death took place on Sept. 5th, at his residence at Cardonald, of Mr. John Thom, consulting marine engineer, Glasgow. Deceased, who was in his fifty-fifth year, and had been in indifferent health for some time, was born at Invertrip, near Wemyss Bay on the Clyde, and received his early training in the works of Messrs. Scott & Co., Greenock, from which he went to the works of the Barrow Shipbuilding Co. (now Messrs. Vickers, Sons & Maxim), Barrow-in-Furness. While chief engineering draughtsman with that company, in the early eighties, he designed and patented a type of economical slide and piston valve, as well as radial valve gear. Returning to the Clyde district about 1890 he started business as a consulting marine engineer, and interested himself particularly in the design and fitting into steamers under his charge of four crank engines, for which reduced vibration, simplification of parts and improved economy were claimed. He was associated for a good many years with the late G. L. Watson, the well-known yacht designer, in connection with the supervision of the machinery of large steam yachts for American and other wealthy owners. He took some considerable share in the proceedings of the Scottish Institution of Engineers and Shipbuilders—of which he was a member since 1889—and in 1890 he read a paper before that body, giving a description of the powerful features of upwards of twenty sets of four-crank engines and their auxiliaries, with which he had had to do in the course of his business. Deceased was also a member of long standing of the Institute of Naval Architects, and for some years past was interested in the pump-making firm of Messrs. Lamont, Thom & Co., Paisley.

Captain Samuel Molyneaux.—We have to record the death, in his sixty-second year, of Captain Samuel Molyneaux, who held the post of harbour-master in Belfast for the past sixteen years. Captain Molyneaux was formerly in the service of the Mersey Dock Board, prior to which he was for some years an officer in the Cunard line. When the post of harbour-master in Belfast became vacant upon the death of the late Captain Tate, the Harbour Commissioners felt that Captain Molyneaux, with his valuable experience gained on the Mersey, was well fitted to take charge of the shipping on the Lagan, and it may be truthfully said that he amply justified his selection. He carried out his duties in connection with the port in an able manner, and his unvarying courtesy and genial manner earned for him the esteem and goodwill of everybody with whom he came in contact, either in public or in private life. Captain Molyneaux left his office on the evening of the 3rd September in full enjoyment of good health, but on his way home he was stricken down. He never regained consciousness, and death claimed him the following day. The deepest sympathy has been expressed on all hands for his widow and daughter in their sad loss.

The Port of Para.—Bucket Dredger "André Reboucas."—Recently there sailed from the Clyde, bound for the Port of Para, Brazil, a powerful bucket dredger named *André Reboucas*, constructed by Messrs. Lobnitz and Co., of Renfrew, for the Port of Para. This dredger was ordered on March 11th, the keel was laid on April 11th, and the vessel ready for trial on July 9th, thus being completely manufactured and delivered within four months from the time of passing the order and creating a record in rapidity of construction for this class of vessel. The dredger is of the non-propelling type, very stiffly and powerfully constructed for dredging to a depth of 46 ft. below water level in hard material, for which purpose the 600 h.p. dredging engines are situated high up near the top tumbler and their gearing is designed in so simple a manner that one may say they practically act directly upon the buckets, and thus work with the greatest possible efficiency in dealing with hard material. The huge shaft of the tumbler over which the buckets turn at the top is of solid steel 19½ in. in diameter, similar to that of the great dredger *Péluse*, owned by the Suez Canal Co. All the gear wheels have their teeth machine-cut from the solid steel. Three large vertical-sided hopper barges were built at the same time by Messrs. Lobnitz & Co., Renfrew, Scotland, to serve this dredger, which will be used by the contractors, Messrs. S. Pearson & Son, Ltd., of Westminster, together with the existing large self-propelling bucket dredger, two large suction dredgers and other floating plant in connection with the important new port works under construction at Para. It may be remembered that in August of last year attention was drawn to a record in quick construction of other work destined for the Port of Para. We refer to the two 1700-ton pontoon docks which are now successfully working at the Ship Repairing Depot there, and which were constructed at Wallsend by Messrs. Swan, Hunter & Wigham Richardson and launched within forty-nine working days from the time of laying the first plate. Of the new port works about 250 lineal metres of new deep quay wall have been built already, and when the great undertaking in hand is completed the Port of Para will afford accommodation of the most up-to-date description for the largest type of ocean-going vessels, rivalling in facilities the ports of Liverpool and Antwerp. It may be interesting to note that the City of Para, where the Port is situated, is a well-built place of about 150,000 inhabitants, and being located at the mouth of the river Amazon, which is the natural outlet of a vast productive area of some 3½ millions of square miles, the possibilities of the Port of Para are enormous.

REVIEWS.

The Apprentices' Course of Experimental Physics and Mechanics. James L. Maxim, B.Sc. 1/6. Longmans, Green & Co., London.

THIS is a book of experiments in which the answers are chiefly found by measurement, and thus fulfil the requirements of apprentices who are preparing to pass the first and second year's preliminary technical examinations of the Lancashire and Cheshire Union of Institutes. It is also of use for students who wish to enter the Oxford and Cambridge examinations in Elementary Science, or who may desire to qualify for the Preliminary Certificate of the Board of Education. It is to be noted that this book is divided into four sections, of which Section 1 comprises ten lessons and deals with the measurement of length, area and volume. Section 2 is included in the next ten lessons which deal with hydrostatic principles affecting the measurement of density and relative density. Section 3—eleven lessons—is concerned with the equilibrium of forces or statics, and comprises lessons in the measurement of forces and of gaseous pressures, whilst Section 4—seven lessons—completes the course by noting the effects of heat and the methods of measuring both temperature and heat. It is suggested here that a whole class of students should be engaged on the same experiment and work independently, as it will be seen that the simplicity and cheapness of the necessary apparatus will remove all difficulties in this direction. The book commences with a specimen list of apparatus supplied to each student, and full notes are given as to the notebooks that should be possessed by each student and the method of working is set out. Many of the questions are without any definite results, so that we may regard these lessons as work set out for the students and must be followed with the results tabulated. In the case of the Vernier scale we find it stated that the scale as expressed may be used to measure to one-hundredth of an inch, and this is followed by certain questions, such as "Find the width of the ruler to one-hundredth of an inch, and such a similar scale to read one two-hundredth of an inch." No explanation of these results or the application of these results are given. The lessons showing the area of the curved surface of a cone and the area of the surface of a sphere are well set out, and the results worth retention. In Section 3 the details shown of experiments with syphon tubes are well worth perusal, and in the various positions with the short leg immersed or with the long leg immersed are very interesting, but we notice that no general explanations as to the statical pressure of the atmosphere in these cases are given. The lessons on the centre of gravity of triangles are well set out and the results are interesting.

BOOKS RECEIVED.

Text Book of Navigation and Nautical Astronomy. By Capt A P W Williamson, F R G S Price 7/6 net London and Portsmouth J Griffin & Co

Norwegian Self-Taught with Phonetic Pronunciation. By C. A. Thimm. 4th edition, revised and enlarged, by P. Th. Hanssen. Price 2/-. Cloth 2/6. London: E. Marlborough & Co., 51, Old Bailey, E.C.

Drawing Book for Marine Engineers. By Alexander Norwell, B.Sc., C.E. Price 2/6 net. Glasgow: James Brown and Son.

CATALOGUES.

Messrs. Geo. Thomas & Co., of 60, Deansgate, Manchester, have just issued a new catalogue, No. 27 E, of Dr. Horn's tachometers, registering tachographs, engine counters, etc. These speed measuring instruments have been brought to a high pitch of perfection. Messrs. Thomas & Co. will send a copy of the catalogue on request.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

New Naval Contracts.—While from a national point of view there can be no gainsaying the satisfaction with which the orders recently placed by the Admiralty for the twenty torpedo-boat destroyers of the current year's Navy programme have been received, the fact that such a large proportion as nine out of twenty, or nearly one-half, has been given to Clyde builders is locally matter of enhanced gratification. The allocation is as follows:—The Fairfield Shipbuilding and Engineering Co., Govan, three vessels; Messrs. John Brown & Co., Ltd., Clydebank, three; Messrs. Denny Brothers, Dumbarton, two; and Messrs. A. & J. Inglis Pointhouse, one. This is the first occasion on which Messrs. Inglis have been entrusted with an order for a destroyer, but the success of the King's new yacht stands to their credit—the turbine machinery in this case, however, being by the Parsons Co.—while they also had practical experience in turbine work through fitting out the Khedive's yacht *Mahroussa*. The cost of each of the new destroyers, which are to be big ocean-going boats of 27 knots speed, burning oil fuel, is understood to be about £95,000, so that the Clyde's share represents something like £855,000. It is generally felt that this should materially assist to the return of prosperity to the Clyde district.

For the four improved second-class cruisers of the Bristol class provided for in the Navy Estimates for the current year, six of the fifteen firms who have sent in tenders are Clyde firms, *viz.*, The Fairfield Shipbuilding and Engineering Co., The London and Glasgow Shipbuilding Co., Messrs. John Brown & Co., Clydebank, Messrs. William Beardmore and Co., Dalmuir, Messrs. William Denny & Brothers, Dumbarton, and the Scott Engineering and Shipbuilding Co., Greenock. Three of these firms are already building vessels of the type; the *Bristol* is on the stocks at Clydebank, the *Gloucester* at Dalmuir and the *Glasgow* at Fairfield. Several Clyde firms also have tendered for the engines to be given out for the new improved "Indefatigable" cruiser which is to be laid down at Devonport, as well as for the improved "Dreadnought" battleship, also to be built in a Government dockyard in the south. Hopes are high that an important share in this further work will be secured by Clyde firms, where engine works, specially organized to cope with such heavy and responsible contracts are by no means too busy.

Merchant-Ship Contracts.—Apart from the new naval work placed and in prospect, the fresh orders which have come to Clyde, Forth and Tay shipbuilders and engineers since last month's notes were penned, form, on the whole—with the new naval work—a somewhat improved budget compared with too many recent monthly reports. The following are the bookings, which are for the most part well authenticated, and in the order of their importance:—

Messrs. Charles Connell & Co., Ltd., Whiteinch, are to build a twin-screw steamer of 9000 tons for Messrs. Donaldson Brothers, Glasgow, to augment their Glasgow and Canadian service at present maintained by the *Athenia* and *Cassandra*. The new vessel, which will have a speed of 15 knots, will have accommodation for nearly 300 second-class and over 1000 third-class passengers, these being the only classes which the Company carry. Engines of about 6000 i.h.p. will be supplied by

Messrs. Dunsmuir & Jackson, Govan. The new vessel is to be ready for delivery in May, in time for the Quebec and Montreal season. The new liner, fitted as she is to be with so much passenger accommodation, will provide work for a larger variety of shipyard hands than in the case of ordinary cargo-carrying vessels, of which Messrs. Connell build so many.

Messrs. D. & W. Henderson, Partick, have booked a contract for a large passenger and cargo steamer for Lisbon owners.

Messrs. A. & J. Inglis have been commissioned to construct a paddle passenger steamer, 300 ft. long, for river service abroad.

Messrs. Wm. Hamilton & Co., Ltd., Glen Shipyard, Port Glasgow, have contracted to build three large cargo-carrying steamers for Liverpool owners. Two of these will each have a deadweight carrying capacity of 7000 tons, while the third will be capable of carrying 8300 tons. All of them will be built on the longitudinally framed Isherwood system, for which Messrs. Hamilton & Co. hold the Clyde licence, and which they have introduced into almost all the vessels they have contracted for since they built the *Craster Hall* last year. With the order for these three steamers Messrs. Hamilton & Co. have now nine steamers of large dimensions on order, eight of which are on the Isherwood system. The machinery for the three vessels just placed will be supplied by

Messrs. David Rowan & Co., Glasgow, the engines being of the triple-expansion type.

The Greenock and Grangemouth Dockyard Co., Ltd., have contracted to build a screw steamer for service in Eastern waters, the order for which has been placed by Mr. J. M. Mushat, through Messrs. John Reid & Co., Glasgow. The engines will be supplied by Messrs. Muir & Houston, Glasgow. The Dockyard Co. also have secured the order to build a floating caisson for a dry dock in China; a class of work in which the Company is not a little experienced.

Messrs. Murdoch & Murray, Port Glasgow, have contracted to build a passenger and cargo steamer for Liverpool owners, with whom they have done business in the past. The new vessel will be engined by a Glasgow firm of engineers.

The Ailsa Shipbuilding Co., Troon and Ayr, have received from the General Steam Navigation Co., London, the order to build and engine a steamer of 1300 tons gross. The new vessel, which will have triple-expansion engines, will be somewhat similar to the *Laverock* launched by the firm last month for the same owners.

Messrs. Ferguson Brothers, Port Glasgow, have contracted to build and engine a powerful bucket-dredger for the Government of San Domingo, West Indies. On Sept. 18th this firm launched, with machinery aboard and steam up, the bucket-dredger *Crewe*, which they have built for the London and North-Western Railway Co. for service at Garston Dock, Liverpool. The vessel is of the bow-well centre bucket ladder type, and is capable of raising 900 tons per hour, being the largest and most powerful bucket-dredger owned by the Company.

The Caledon Shipbuilding and Engineering Co., Dundee, are to build a steel screw steamer of 1300 tons gross register for Mr. Thomas Cowan, Leith.

Messrs. A. Hall & Co., Ltd., Aberdeen, have received an order from Mr. W. M. Brechin, coal merchant, for the construction of a small steamer to be engaged in the coal-carrying trade. The same firm has also received an order from Hull owners for a steamer to be engaged in the grain trade.

Fairfield Works.—The latest production from the Fairfield stocks—the twin-screw steamer *Prinses Juliana* for the Queenborough-Flushing service of the Zeeland Steamship Co., Ltd., about the beginning of September ran a series of trials over the measured mile at Skelmorlie with results most creditable to all concerned, all the more so that they have been reproduced in actual service since. She is now on her station in the night service between Queenborough and Flushing. The second vessel of the trio for the Zeeland Company—the *Oranje Nassau*—is now being fitted out in the Fairfield basin, while the third is still on the stocks and nearing the launching stage.

Destroyer Speed Trials.—After a prolonged series of speed and other trials on the Clyde, the torpedo destroyer *Swift*, one of the fastest vessels in the world—her contract speed being 36 knots per hour—left Greenock on Sept. 21st for the Mersey. It is understood that the Admiralty representatives are highly pleased with her performances, and that her speed is well over the guarantee. The *Swift* is driven by oil fuel, and it is gathered from enquiries in official circles that the records taken on the Clyde show her consumption to be under the specified amount. On the passage to the Mersey it was intended that a slow consumption test would be taken, and that on arrival in the Mersey further full power tests would be made. The *Swift's* machinery will then be opened out for inspection and overhaul, and it is anticipated that she will be handed over to the Admiralty in the course of a few months.

The London and Glasgow Shipbuilding Co.—This Company is making good progress with their 27-knot torpedo destroyer for the British Admiralty, the order for which they received about the beginning of the year. In order to be better able to compete for the construction of turbine machinery and large reciprocating engines, it has been considered necessary to convert the erecting shop at the engine works into a more modern machine and fitting shop, and to utilize the company's ground on the east side of the works for building a new erecting shop. All this is now in a forward state of progress, and when completed should tend to materially reduce the cost of ship construction in this establishment.

"Weirs," of Cathcart.—It may perhaps be taken as indicating a "turn of the tide" in industrial affairs associated with shipbuilding and engineering, that this well-known pump making firm has recently received a number of good orders. To cope with this they have added something like 150 hands to their ordinary working staff, which now numbers about 1250 men.

Electric Power in Shipyards.—There is at present being put into operation in the shipyard of Messrs. Wm. Simons and Co., at Renfrew, new electric power plant which is interesting as indicative of the very widely extended use of electric power nowadays from power supply company's mains. Messrs. Simons have dispensed entirely with the use of steam plant, both for shop driving purposes and generating electric energy, and have installed 3-phase 25-period alternating current from the Yoker Station of the Clyde Valley Electric Power Co. The feeders at a pressure of 11,000 volts cross under the bed of the river Clyde at Yoker to Renfrew in duplicate for their ring main system. In the sub-station in Messrs. Simons' yard there are installed two 500-kilowatt three-phase static stepdown transformer units, reducing from 11,000 to 400 volts. The transformer units and all extra high-tension apparatus are completely insulated, but by means of remote control gear either or both of the units can be put into commission as the leads should necessitate, so reducing the conversion losses to a minimum. Besides the sub-station with the plant above indicated, there has been installed in the new power house an alternating current switchboard, a direct-current switchboard, two motor generators and one rotary converter, as well as two powerful Ingersoll-Rand air compressors, motor-driven by belt for the pneumatic tool plant throughout the shipyard and boiler works.

THE TYNE.

(From our Own Correspondent.)

The Palmer's Shipbuilding and Iron Co., Ltd.—The announcement has been made that an order for a large cargo boat has been placed with the eminent Jarrow company, and it is understood that negotiations for the settlement of other orders have been entered on. Throughout the shipbuilding and marine engineering departments there is an appearance of bustle, and there is reason to look forward to the maintenance of comparative briskness during the next few months, and perhaps for even a longer period.

The Commercial Dry Dock Co.—This important ship-repairing company, which during the past year or so has largely increased its resources, has been kept well engaged during the whole of the present year putting many survey contracts through hand, in addition to quite an exceptional number of painting jobs. At the moment there are two or three large vessels being overhauled in the Company's graving docks, and it is understood that other repair contracts are expected in the near future.

Messrs. Hawthorn, Leslie & Co., Ltd.—We are pleased to be able to state that this firm, who in the past two decades have turned out so many successful torpedo destroyers and other vessels for the Admiralty, have been commissioned to supply three destroyers of a superior class towards fulfilment of the Government's latest programme, and have also booked an order for a vessel of close on 11,000 tons capacity for Swedish owners. It is expected that the revival of business will be accentuated by the early acquisition of orders for the graving dock department

Messrs. Swan, Hunter & Wigham Richardson, Ltd., have just received their first Admiralty contract in the shape of a commission to build one destroyer. This contract will, doubtless, in time be followed by others, as it is on the cards that the firm, having decided to cater for Admiralty requirements, will make special provision for the building and equipment of Government vessels. It is also announced that the Company have received an order from the Cunard Company for another Atlantic passenger steamer of the largest class. There is other work in hand, and the outlook at this great establishment for the winter months is eminently encouraging.

Wallsend Slipway Co., Ltd.—At the Wallsend Slipway Co.'s works it is understood that orders have been booked lately, and an improvement in all departments is looked forward to. The graving dock is at present occupied with a large vessel undergoing a general overhaul.

Messrs. Wood, Skinner & Co., Ltd.—At the Bill Quay yard of Messrs. Wood, Skinner & Co. most of the building berths continue to be occupied, and it is understood that some new orders have recently been placed.

Northumberland Shipbuilding Co., Ltd.—This Company has, during the depressed period, continued to keep a fair supply of work on the stocks, and is still in a position to keep the greater number of its berths occupied.

Messrs. Readhead & Sons.—The announcement has just been made that one of the four new steamers about to be added to the Prince line, is to be built by Messrs. Readhead. The firm has also a fair amount of work in its repairing department.

Messrs. Armstrong, Whitworth & Co., Ltd.—An interim dividend of 10 per cent. on the ordinary shares and one of 4 per cent. on the preference shares, free of income tax, was declared by the directors of this Company at its meeting held at the Elswick Works on the 16th instant.

Messrs. Clark, Chapman & Co., Ltd.—This well-known Gateshead firm continues to show a fair degree of briskness in its various departments of electrical work and in the manufacture of steamship auxiliary machinery. The firm's steel boat department is also kept pretty busy.

Messrs. W. H. Holmes & Co., Ltd., electric light engineers, are still very busy at their works, Portland Road, Newcastle, ship lighting constituting a large proportion of the work in hand. The firm has had many important contracts this year.

Messrs. Henry Watson & Sons.—This up-to-date firm is still having enough work to keep the machinery running full time in many of the more important departments, and there is little reason to doubt that the recent accession of orders to Tyne shipyards will result in an augmentation of the work at the High Bridge establishment.

Messrs. Newton & Nicholson.—The corrugated packing works of this company at Tyne Dock are kept busily going, the demand for the firm's original speciality being well maintained, and there being also a good demand for other products upon the manufacture of which the firm have recently entered.

General.—Other engineering firms at this centre are doing fairly well, especially those engaged in repairs to marine engines and boilers. Timber imports at Tyne Dock have not been numerous lately; but an increase is expected to take place now that the labour disturbances in Sweden have been terminated.

THE WEAR.

(From our Own Correspondent.)

Messrs. Priestman & Co. have been commissioned to build two steamers for the Prince line, Newcastle, and the preliminary work is now being proceeded with.

Messrs. Short Bros.—Another steamer for the Prince line has been allocated to this firm. This makes four steamers in all to be added to the Prince line.

Messrs. Pickersgill are commencing the construction of a medium sized vessel, but there are not evidences of the existence of other work in the yard.

The Southwick Engine Works (Messrs. George Clark and Co.) have been exceedingly bare of work for some time, and though enquiries are now heard of, it has not transpired that any new contracts have been placed. The firm has taken advantage of the slackness to improve the equipment of its works. Among other additions in course of being made is a mammoth crane for the quay. This crane has been designed and constructed by Messrs. Appleby, Ltd., of London, Glasgow and Leicester, the structural work being subcontracted to Messrs. Markham, of Chesterfield. The crane is capable of lifting loads up to 125 tons, and is bound to be a most effective aid in the fitting of engines and boilers in ships.

Laing's Yard.—The most convincing proof of a real trade revival that could be presented in Sunderland would be the re-opening of this establishment. This event however, seems no nearer than at the opening of the year, and it is a curious commentary on the present condition of the shipbuilding industry that this—one of the most elaborately equipped yards in the kingdom—should be permitted to lie derelict for nearly two years.

Messrs. J. L. Thompson & Sons, Ltd. for many years have held the place of prominence among Wear shipbuilding firms, are again presenting the appearance of general activity which used to be their permanent characteristic in former days, and there is reason to believe that this improved condition will be maintained. The machinery equipment, especially in the matter of riveting and caulking accessories, has been substantially added to, and economical production has, in connection with these branches of work been correspondingly increased. The Manor Quay, adjunct to these works, which is used as a repairing and fitting-out department and has a special and complete machinery equipment of its own, is now showing a fair state of briskness.

The Scotia Engine Works.—For many months past these works have constituted an exception on the Wear, having been kept in a state of continuous briskness, whilst most of the other establishments were slack. A vessel has recently arrived from the Tyne for engines and boilers to be fitted, and it is expected that other vessels are to follow.

Messrs. Austin & Sons, Ltd., have at the moment several vessels under repair, and in the new work department good progress is being made with the vessels in hand. The locally owned steamer *Munificent* is now receiving an extensive overhaul, including shell repairs, on the pontoon.

Wreath Quay Works.—Messrs. MacColl & Pollock, of the Wreath Quay Works, have a considerable amount of work in hand, and are able to keep all their departments pretty steadily going. A large fishing vessel built at a neighbouring port has arrived at the quay to be fitted with machinery, and it is understood that other vessels to be similarly fitted are expected. The slight improvement that has been manifested in local foundries is maintained, and manufacturers of auxiliary steamship machinery are becoming busier. In local electrical works the state of business continues to be fairly active.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dock yard, have secured the contract to build two large cargo and passenger boats to the order of Messrs. Elder, Dempster and Co., Liverpool, the machinery will be built by the North-Eastern Marine Engineering Co., Sunderland, and Messrs. Richardsons, Westgarth & Co., Ltd., also of this port, respectively.

Messrs. Smith's Dry Dock Co. are to build a coasting steamer to the order of Messrs. The Meteor Steamship Co. This will be the first boat built at their new yard on Teeside.

Messrs. Richardsons, Westgarth & Co., Ltd., have secured orders to build three sets of engines and boilers, and are now very busy with the Nestdrum boiler, which is gaining favour for land work.

Stockton and Thornaby.

Messrs. Robert Ropner & Son have secured the contract to build two large steamers to the order of Messrs. Constantine and Pickering Steamship Co., Middlesbrough, also a cargo boat for Messrs. W. R. Smith & Son, Cardiff, to carry about 6300 tons deadweight on about 21-3 draught for delivery in February or March next, the price reported being £33,250.

Messrs. **Blair & Co.** are reported to have secured orders for four sets of engines and boilers for steamers building locally.

Messrs. **Craig, Taylor & Co.** are reported to have secured orders for two cargo boats.

West Hartlepool.

Messrs. **W. Gray & Co.** have secured another contract during the month, which makes six steamers now building, four at the new yard and two at the old yard; they have also been busy with repair work.

Messrs. **Irvine's Shipbuilding and Dry Dock Co.** have secured a repeat order for a small collier similar to the one now building at their Harbour Yard. They have launched the steamship *Winnebah*, this being the second boat on order for Messrs. Elder, Dempster & Co., Liverpool; the remaining four steamers for this firm will be built at the Middleton Yard. The success of the steamship *Teessider*, recently built by them for the Tyne-Tees Steam Shipping Co., Ltd., has greatly enhanced the reputation of this yard, and in consequence of which the company are considering the advisability of placing a repeat order with Messrs. Irvine's Dry Dock Co. I may incidentally state that the steamship *Teessider* is doing half a knot more speed and carrying 100 tons above the contract requirements.

The West Hartlepool Steel Works have started a considerable number of men, the orders booked are expected to keep them busy during the winter. This will very considerably relieve the distress in the town.

S.S. Netherton.—The steamship *Netherton* has been sold by Messrs. W. H. Loveridge & Co. to Messrs. Sota & Aznar, Mine and Dry Dock owners, of Bilbao and London, who will renew the destroyed portion out at Bilbao (see July notes). She is reported to have been sold for about £8000. Captain Flanders, of London, contracted to deliver her in Spain. Messrs. Loveridge have disposed of the Lumley Steel Works to Messrs. Waring & Lames, of Sheffield, and are expected to resume operations shortly.

Hartlepool.

Messrs. **Irvine's Shipbuilding and Dry Dock Co.** have secured the order for two more steamers of large carrying capacity for Messrs. Furness, Withy & Co., making six steamers placed with this firm by Sir C. Furness under the co-partnery scheme at this yard. Sir C. Furness has sold a second boat to Messrs. Jos. Hoult, Liverpool, the steamship *Bendew*, a co-partnery steamer. They have also been busy with repair work, their dry docks being constantly in use.

Messrs. **Richardsons, Westgarth & Co.** have secured the contracts to supply the machinery for the small steamer to be built at Messrs. Irvine's Harbour Yard, also the two large steamers to be built at their Middleton Yard. They are to supply the machinery for one of two twin-screw steamers to be built for Messrs. T. B. Royden, Liverpool, under the superintendence of Messrs. Esplen and Son, also of Liverpool. Messrs. Workman, Clark, of Belfast, will build one steamer and Messrs. Swan, Hunter, Wallsend-on-Tyne, will build the steamer to be engined by Messrs. Richardsons, Westgarth & Co. In this case the machinery will have to be shipped to the Tyne, on account of her size; she is of 5000 i.h.p. and 13 knots. They have now fifteen steamers building to be fitted with their contraflo condenser, and orders for about ten others to commence.

THE HUMBER AND DISTRICT.

(*From our Own Correspondent.*)

We regret to report the death of Capt. Forrest, R.N.R., Superintendent of the Hull Mercantile Marine Office, who passed away at his residence, Westfield, Beverley, on the 19th August, his demise following a long illness. The late Captain Forrest was appointed Examiner of Masters and Mates 1891, and he succeeded to the position of Superintendent in 1902. He identified himself with the Training Ship *Southampton*, being a member of the Committee, and also interested himself in the Sailors' Home. Captain Forrest was always keen in seeing that gallant deeds were rewarded, and always made it a point of attending any presentations to the Heroes of the Ocean. He will be greatly missed by Masters and Engineers.

Mr. L. Stromberg, R.N.R., who has been in the Hull office from boyhood, with a service of thirty-six years to his credit, has been appointed by the Local Marine Board to the position of Superintendent. Mr. Stromberg has the great respect of the mercantile public of this port.

Earle's Shipbuilding and Engineering Co., Ltd., keep fairly busy with repair work, and are employing at present a great number of skilled men, but are far from being busy. They have enquiries, and they may soon fill up the empty stocks with new steamers. They have splendid facilities, and their shops are fitted with up-to-date machinery.

Central Dry Dock and Engineering Co., Ltd., Hull, have plenty of work. The steamer *Ariel* has been undergoing extensive repairs, twenty-six new plates having been put into her bottom, also new floorings and other general repairs. The s.s. *James Westall* has been docked, and she will have to receive new stem and plating and other repairs, which will necessitate the expenditure of a considerable sum of money before she is ready for commission again. The repairs to the Cardiff steamer *Whitegift* at the Alexandra (Dry) Docks, have been completed. The Company has had several times during the month to hire the Dry Docks outside their own, having had so much work on hand.

Humber Iron Works, Engineers and Ship Repairers, have been fairly busy with docking and repair work. They have also had the s.s. *St. Katherine* undergoing a thorough overhaul, putting her through Lloyd's Survey. This steamer, which is changing owners, was also on the firm's patent slip, sighting bottom, etc. A number of enquiries for new work, and the use of their patent slips have been received by the firm.

Grimsby.—The Engineering and Boilermakers' repairing shops around the Fish-Docks are all in the hands of the different trawler owners. The general state of trade is bad. Several companies have trawlers laid aside in the docks, the cost of running being too great. Trawlers have so far to go now to get fish, and prices are low.

Cook, Welton & Gemmell, Shipbuilders, Beverley, are a little brisker during the month. At the end of August they launched the Motor-Barge *Tetney*, for the Tetney Oil and Manure Co., of Grimsby. Dimensions, 60 ft. by 15 ft. by 6 ft., moulded depth, driven by a 42-H.P. 6-cylinder internal combustion motor. Cylinders $4\frac{3}{4}$ in. by 5 in. stroke, built by Fairbanks Co., of London. On September 2nd was launched the s.t. *Gabir*, for Messrs. Baker & Grant, of Grimsby. Dimensions, 117 ft. by 21 ft. 6 ins. by 11ft. 6 in. depth of hold. Also launched for the Queen Steam Fishing Co., of Grimsby, the s.t. *Consort*, engined by the same firm as the *Gabir*, *viz.*, The Great Central Engineering Co., of Grimsby. On the 16th September, the s.t. *Calphurnia*, for the Alliance Steam Fishing Co., of Grimsby, was launched. Dimensions, 135 ft. by 22 ft. 6 in. by 12 ft. depth of hold. Engines and boiler by the well-known firm of C. D. Holmes & Co., Ltd., of Hull.

W. H. Warren, Shipbuilder, New Holland.—This yard seems always to be to the fore in receiving orders. At present they are building the following steel lighters, etc.:—2 steel lighters, 300 tons; 1 steel lighter, 180 tons; 1 steel coasting steamer, 95 ft. by 17 ft. 10 in. by 9 ft., all being orders from Hull.

Cochrane & Sons, Shipbuilders, Selby, are now receiving enquiries, and the outlook seems improving. They are fitting out a large Portuguese trawler, which is to be well equipped for fishing in southern waters. The firm has also booked an order for a trawler for Grimsby owners. Some fine passenger steamers for the China trade have been built by this firm in the past.

Goole Shipbuilding and Repairing Co., Ltd., have only two steamers on the stocks at present. One is a passenger steamer for Eastern trade, and the other vessel is a handy coasting steamer. They have been very busy with repair work all through the summer.

C. D. Holmes & Co., Ltd., Engineers and Boilermakers, Hull, like many other engine works, are lacking fresh orders. They have been in the past very successful in engining and boilering trawlers, but as the trawler owners are not placing orders for building, it makes the firm slack. They had adapted themselves to this class of work, but are now going in more for repair and dock work.

Amos & Smith, Engineers and Boilermakers, Hull, keep

receiving orders from foreign shipbuilders for their steam-steering engines and auxiliary engines.

Cooper & Co., Engineers and Boilermakers, Hull, are doing a fair amount of repair work, dry docking, etc.

Stewart & Craig, Engineers and Boilermakers, Hull, are keeping fairly busy with general repairing work around the docks.

Gemmell & Frow, Engineers and Boilermakers and Ironfounders, are building steam-steering gears, capstans, and bollards, and auxiliary engines for British and foreign owners. They left St. Andrew's dock site some time ago, and built engine and machine shops on their Foundry Grounds, West Hull, where all enquiries are to be made. They keep fairly busy with orders received some time ago, and are now looking for further new orders.

SOUTHAMPTON.

(*From our Own Correspondent.*)

Messrs. Day, Summers & Co., Ltd., Northam Iron Works, are repairing the p.s. *Duchess of Kent* which was in collision with the s.s. *Transporter* in Portsmouth Harbour on the 4th of last month. The *Duchess of Kent* received extensive damage on the port side just forward of the bridge, and was brought to Southampton and dry docked, where temporary repairs were executed preparatory to moving the vessel to Messrs. Day, Summers' yard. The vessel was built by them in 1897.

The new tug for the Isle of Wight S.P. Co., is making good progress, and the following yachts have come up to their mud berths for the winter. *Medusa, Catania, Madrigal* and *Highwayman*.

The s.y. *Honor*, owned by Baron de Forest, was docked last month and had tail shaft drawn for survey, after which she also went to her mud berth.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston, have been favoured with an order for four ocean-going destroyers for the British Admiralty. It is reported that the value of this contract will amount to about £350,000, and will mean plenty of work at the yard for about eighteen months. An order has also been received from Russia for a light shallow draught tug boat, one of the conditions being that the vessel is to have a speed of 14½ knots on a draught of 16 in. Last month the firm were also very busy carrying out various work in connection with the annual fitting out of H.M. transports for Indian and Colonial service. As an instance of the despatch the firm are able to give in connection with topedo boat destroyers, etc., it is interesting to note that the T.B.D. *Nubian* (33-knot destroyer) has been handed over to the Admiralty two months ahead of the contract date. Work is well advanced on H.M.S. *Savage*, ocean-going destroyer building for the British Admiralty.

S.S. "Transporter."—This vessel, as previously reported, was in collision with the P.S. *Duchess of Kent*, and was also docked here. Messrs. Thornycroft carried out the necessary repairs, which included two new bow plates.

The London and South-Western Railway Company.—It is reported that the London and South-Western Railway Co. have placed an order with Messrs. Cammel, Laird & Co., of Birkenhead, for two new turbine cross-Channel steamers, which are to be the largest and fastest owned by the Company. Their length is to be 300 ft. and the speed 20 knots. The details of the internal arrangements of the vessels have been worked out by the Company's Southampton staff. It is understood that Professor Biles will carry out the work of inspection on the Company's behalf, whilst the vessels are being constructed. These two vessels are expected to be in Southampton by the 30th June, 1910, ready to take up their positions in the Company's Channel service. Important developments are to come into force this month and the dock staff is being thoroughly reorganized and strengthened as required. The whole concern is to be placed under one central authority having the present docks and marine superintendent (Mr. T. M. Williams) as the head, and he will take over the control of all the departments at the docks, ships, railways, machinery and dock works. The Company's fleet at present numbers some twenty steamers, and lately some of the older steamers have been equipped with refrigerating machinery in order to deal effectively with the carriage of dairy produce, also quite recently the Company have extended their service to Roscoff, which has increased the passenger service considerably. It was announced (some months ago) that the site of the new dry dock was to be at Woolston, but it is now reported that the directors have under consideration the desirability of having a floating dock. Good progress is being made with the large new wet dock, and it is anticipated that it will be completed well within the contract time. Important negotiations, we understand, are now in progress, which will lead to a substantial increase in the shipping business of the port.

Messrs. Sumners & Payne, Ltd., Belvidere, Northam, are busy with an order for five 30-ft. cutters for the Admiralty and work on these is well advanced. The s.y. *Primrose* (35 tons), Messrs. Ellis, Kislingbury & Co., is at the yard being completely refitted internally and on deck. A new boiler is also under construction for this yacht. On completion of the repairs she will be shipped to Patagonia. *Greta* (393 tons), Mr. W. K. Bailey, is having attention at the yard. *Tighnamara*, 157 tons, Mr. J. Allan, has been launched off the slip and reberthed on the mud for completion of survey.

The following yachts are at the yard lying up for the winter. *Zenaida*, 812 tons; *Grianaig*, 439 tons; *Lavanda*, 338 tons; *Lady Evelyn*, 369 tons; *Pleione*, 22 ton motor yacht, and *Norseman*, auxiliary screw barquentine 521 tons, owner, Earl of Lonsdale, is at the buoys awaiting orders.

THAMES.

(*From our Own Correspondent.*)

London and Shipbuilding.—A deputation of East End members of Parliament waited recently on the First Lord of the Admiralty to urge the claims of naval shipbuilding orders, but the reply has not given a great amount of satisfaction. The appeal for preferential treatment has been answered by Mr. McKenna in the negative. That the prices recently quoted by the Thames Ironworks have been rather high is due to the fact of the increasing burden of local rates, the extra charge for material and fuel, and the London rate of wages for ordinary, overtime and night shifts. The quality of the work has not been at fault, but it is the incidence of the extra charges that has driven the work away.

New Port Dues.—A draft schedule of maximum rates on goods has just been issued by the Port Authority, and opinions have been invited from leading firms concerned with a view to avoiding any undue restrictions or hardship on any particular branch of trade involved. A feature of the schedule is that it levies dues on all goods entering the Port of London. We cannot enumerate these imposts, which generally seem reasonable, but machines and machinery are to pay 1s. 6d. per ton. When the figures are agreed upon they will be subject to ratification by the Board of Trade.

Strike of Thames Watermen.—What might have led to a great disorganization of business on the river has been averted. The dispute has been between the master barge owners and lightermen and the Amalgamated Society of Watermen over an award made in 1889 by Lord Brassey as to the hours of apprentices in the employment of the masters, and whether the latter had the power to call on the former to serve more than a 12-hour day and as to the times of such serving. The question affected 200 apprentices, and until a decision was made they remained "out." There are 4000 members in the association, and the coming out of such a number as this affects 20,000 or 30,000 men engaged in and near the docks. The lightermen are licensed, and no one can bring a barge up the river without a license, so the issue has been a somewhat serious one. The conferences of masters and men were arranged by the Board of Trade under the presidency of Mr. Askwith, K.C.

Thames Steamboats. The company formed to purchase the boats that belonged to the London County Council has not found it easy work to make a start with subscribers. The fourteen boats are offered to the company for £10,000. At the time we go to press it is not clear if a satisfactory issue has been come to, and if we shall see the boats again on the river under the new management. At the reduced figures and private ownership there is a chance of some success being attained. We shall not have long to wait for results as a day was named for the inauguration of the service.

The "Nimrod" on the River.—This vessel of the Shackleton Antarctic expedition has been berthed near the Temple Pier. An exhibition of some of the mementoes of exploration will be held on board, and the central position in which the vessel will be will ensure great interest being taken in her with some of the original crew to conduct visitors round.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

THE engineering trade in Liverpool has, unfortunately, been comparatively quiet during the past month, but there is every sign of future improvement, both as regards repair work and new contracts, and enquiries made in several reliable sources reveal a pretty optimistic outlook.

Messrs. Cammell, Laird & Co., Ltd., have received the order for the new steamer for the London and North-Western Railway Company. The new vessel is to be for their Holyhead and Dublin service, and is to be fitted with turbine machinery which, I understand, will be supplied by Messrs. Cammell, Laird & Co., Ltd. In their repair department Messrs. Cammell, Laird & Co., Ltd., have had their full share of work that has come to Liverpool during the past month. At the time of writing they have in hand a fishing trawler called the *Mabel*, a Norwegian steamer named *Havso*, and several other more or less extensive contracts for overhaul and repair. The new coal elevator for Clarke's patent Automatic Coal Barge Co., Ltd., is also nearing completion, and will shortly be delivered, and the second new turbine liner *Hallaga*, for the Compania Peruana, has also undergone her official trials.

Messrs. Clover, Clayton & Co., Ltd., have a number of repair jobs in hand, including the *Rostrevor* (which was recently in collision in the Mersey, very badly damaging her stem), also the coasting steamer *Napoleon* and a German sailing vessel called the *Oregon*.

Collision in the Mersey. Schooner Sunk.—On Saturday, the 21st August, a disastrous collision occurred in the Mersey by Egremont Pier, resulting in the beaching of a schooner which subsequently capsized. The schooner *Gaelic* was proceeding up the river when she collided with the coasting steamer *Rostrevor*, belonging to Messrs. John Edwards and Co., of Liverpool. The *Gaelic* was badly damaged, sustaining a large hole in her port side, which rapidly filled with water as she was being towed nearer the shore, where she turned completely over and became entirely submerged. The *Rostrevor* struck the *Gaelic* with her bow, sustaining a very badly twisted and bent stem. She is now undergoing repairs at the hands of Messrs. Clover, Clayton & Co., Ltd The *Gaelic* was taken in hand almost immediately after she sank by the well-known salvage contractors, Messrs. John Gibney and Sons, and after extensive operations, lasting about ten days, she was floated, righted and taken into dry dock at Garston on September 2nd.

New Cunarder.—It has now been officially announced that the order for the new vessel to replace the lost *Slavonia* has been placed with Messrs. Swan, Hunter & Wigham Richardson, Ltd., and the engines will be built by the Wallsend Slipway and Engineering Co., Ltd. The new vessel is not intended to approach anything like the *Mauretania* or *Lusitania*, as was at first anticipated, but she will be a first-class ship in every respect. Her length is to be 580 ft. and the speed 20 to 22 knots. The passenger accommodation will certainly be equal to that of the two leviathans, if not better.

Messrs. John Bacon, Ltd., have placed an order for a new steamer with Messrs. Murdock & Murray, for their coastal service between Liverpool, South Wales and South of Ireland. She is to be a duplicate as far as possible of their steamship *Wexford*, which was also built by Messrs. Murdock & Murray. Engines will be supplied by Messrs. Muir & Houston, Ltd., of Glasgow.

Messrs. James Chambers & Co., I understand, have placed an order for a new vessel with engines by Messrs. Geo. Clark, Ltd., of Sunderland.

Messrs. M. Langlands & Sons.—The new steamer for this firm has now been placed with Messrs. The Caledon Shipbuilding and Engineering Co., Ltd., of Dundee.

Booth Steamship Co.—The new vessel for this company has now been placed with Messrs. Barclay, Curle & Co., Ltd., and is to be a duplicate of the ship ordered from the same builders a few weeks ago.

Messrs. T. B. Royden & Co.—Further to my previous intimation that this firm was negotiating for three new steamers, I understand that the second vessel has just been placed with Messrs. Swan, Hunter & Wigham Richardson, Ltd., with engines by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool. This makes two vessels at present in hand, one with Messrs. Workman, Clark & Co. and one as above, and a third yet to be placed.

Lancashire and Yorkshire Railway Co.—The order for a new steamer has been placed with the Wallsend Slipway and Engineering Co. for the Lancashire and Yorkshire Railway Company's Goole and Continental service.

Newly-built Peruvian Liner in Collision.—The new Peruvian liner *Huallaga*, which has just been completed by Messrs Cammell, Laird & Co., Ltd., was returning to Tranmere Dock, Birkenhead, after undergoing her trials (which I understand have been in every way highly satisfactory), when she was run into by the schooner *Alert* on Sept. 9th whilst lying at anchor in the river Mersey off New Ferry, doing considerable damage to the *Huallaga*. The *Alert* struck the *Huallaga* about the starboard quarter, and in addition to damaging a considerable amount of deck housing, and deck fittings, etc., the *Alert's* bowsprit pierced the shelter deck, carrying away several stanchions. So far as the *Alert* was concerned she sustained no further damage than a broken bow-sprit and a slight damage to rigging. The *Huallaga* is the last of the two Peruvian turbine liners built by Messrs. Cammell, Laird & Co., Ltd., and is an exceedingly fine ship with handsome passenger accommodation and fitted throughout in the most up-to-date style. Both these liners are turbine-driven, and the machinery has been supplied by Messrs. Cammell, Laird & Co., Ltd.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

The Vickers Company and Admiralty Work.—We are now beginning to feel at Barrow the effect of the arrangements which were made with the Admiralty by Messrs. Vickers at the beginning of this year in relation to Admiralty work. Up to the present the orders have been confined to armaments, but before long we shall be hearing some good news, regarding a "Dreadnought." Some few months ago the Company commenced to enlarge their already extensive machine shops, and it was then that one got some idea of the volume of work that was to be put in hand. At present they are at work on the guns for the Jarrow-built vessel and the one at the Dockyard, and on the new 13·5-in. guns for the super-Dreadnoughts, the orders for which have not yet been placed.

Japanese Work.—I understand the Japanese order which Mr. Douglas Vickers brought back with him from that country is a pretty big one, and is to be shared with Messrs. Armstrong. There was a time when these two firms used to get a lot of work from Japan, but now that country is beginning to make its own vessels, but they have not got so far advanced as to aspire to the construction of 12-in. guns.

Spanish Work.—Work in connection with the Spanish orders is beginning to assume shape, but, of course, the yard at Ferrol is not yet completed, and but very little is known of the progress made with the work. The Spanish work will, of course, mean more guns to be built at Barrow, so taking this department and its prospects for the future one can say at the very least that they are in for a big run of activity.

The Floating Docks Plates.—It was hoped that the order for the plates would have found its way to the Barrow steel works, which possess some fine plate mills. One was sanguine owing to the fact that the Scotch makers were full of orders and as they held three months' work they could not according to agreement book more. Anyhow, the matter has been settled by the order for some 9,000 tons going to Messrs. Guest, Keen & Nettlefold, and they will be rolled at their new works at Cardiff.

Aberdeen Floating Dock.—Work is proceeding with the floating dock for Aberdeen, which is to be large enough to lift three large steam trawlers. When the second-class

cruiser *Liverpool* comes off the stocks the two floating docks will be the only two jobs on which the platers will be working excepting, of course, the submarines.

The Brazilian Floating Dock.—It has taken some time for this order to get placed, but the plates have now been ordered by Messrs. Vickers. A number of firms in this country, Germany and America tendered for this gigantic dock and the prices are interesting. The dock will be capable of lifting 22,000 tons, so that allows a margin of about 1,000 tons in the case of the *Minas Geraes* and the *Sao Paulo*. The following is a list of the tenders :—

Name of Tenderer.	Time required for building and delivery at Rio de Janeiro.		Amount including towage
Messrs. Cammell, Laird & Co., Ltd., Birkenhead	$12\frac{1}{2}$ months	..	£182,500
Messrs. Vickers, Sons and Maxim, Barrow (including Armstrongs and others) ..	11 months	..	182,700
Messrs. Swan, Hunter & Wigham Richardson, Ltd., Newcastle-on-Tyne	14 months	..	204,500
	12 months	..	212,500
Compagnie des Forges et Chantiers de la Mediterranée (La Sayne), Toulon .	18-20 months	..	262,436
Blohm & Voss	12-15 months at Hamburg	..	307,000
Maryland Steel Co., Baltimore, U.S.A.	12 months	..	371,000

There are two other tenders from Germany, but they were late and at the same time were out of it in price, being over £200,000. The cost of towage will be a serious one, and very likely, as the dock will be built on the three section principle, they may be towed out separately. The various prices are remarkable. It is strange that the American tender should be double that of Messrs. Vickers.

H.M.S. "Vanguard."—Work is proceeding apace with the Dreadnought *Vanguard*. This vessel is still occupying the inside berth, and all of the large 12-in. guns have been put into position and completed. It is hoped to have this vessel ready for her trials (builders) by the beginning of November, and everything seems to point to the fact that this will be achieved. The *Vanguard* is to be ready for delivery in April next. Two tripods have been fixed and the masts for signalling and wireless are also in position, and in the engine rooms they are not far off being ready. Hydraulic machinery tests have already been made.

The Brazilian "Dreadnought."—A lot of machinery and boilers have been placed into the *Sao Paulo*, and this is being erected. When the *Vanguard* has got all her heavy weights great strides will be made in the completing of this vessel. Practically everything in connection with this vessel is ready. Many of the engineering staff of Messrs. Vickers are away on the trials of the *Minas Geraes*, which was built at Messrs. Armstrong's and engined by Messrs. Vickers. The contract speed is 21 knots. It will be interesting to know the full details of this trial and compare them with the results of, say, the *Vanguard*. The latter has turbines, while the Brazilians have reciprocating engines. The i.h.p. is 500 in favour of the Britisher. The speed, the coal consumption per horse per hour, etc., will be interesting reading.

The Cunarder.—The order for the Cunard intermediate steamer has gone to the Tyne. An order such as this would be a fine thing for Barrow, for it would find work for all the trades and might mean the stepping stone for further orders of the same kind.

The Ice-Breaker.—The Canadian ice-breaker *Earl Grey* has finished her trials and has left for Canada. Her contract speed was 16 knots, but on her trials on the Clyde she performed a mean speed of $17\frac{1}{2}$ knots without "burning the funnel," as the saying goes. There is some talk of more work from Canada and cruisers are suggested.

The Airship.—Work on the piling in the Cavendish Dock for the airship shed is proceeding and in a month or two things will be taking shape. Great secrecy is maintained about this dirigible which Messrs. Vickers are constructing for the Admiralty. Several officers in the Navy are busy with the details and Rear-Admiral Bacon is constantly engaged on the preliminary work. This means a big thing for Barrow, and may be as important eventually as the submarine construction.

Hæmatite Iron and Steel.—There is a better tone in the iron market and prices are much firmer. This rise is due to the general improvement in demand on the part of steel constructors in this country. Warrants have risen to nearly 61s. per ton net cash, while three months iron is at 62s. 6d. Makers are asking 63s. per ton net f.o.b. for mixed Bessemer numbers, while better qualities are making more money. The warrant stores have risen to 15,000 tons, which is really very little and strengthens the position of the smelter. In the steel trade work is confined to the rail mills. The new combine in West Cumberland has fixed everything up and they now propose to develop their shipping ports in order to permit of larger vessels using them.

Shipping.—Shipping generally is dull and freights are low. The shipments of iron and steel show a weekly increase. The total shipments to date this year are something like 80,000 tons ahead of the corresponding period of last year.

BELFAST.

(From our Own Correspondent.)

State of Trade.—There is room for considerable improvement in the matter of activity in shipbuilding and engineering, the various trade societies still reporting large numbers of their members receiving "idle money." Orders are certainly said to have been booked from time to time, but these appear to be slow in taking shape. However, better times are to be looked for after a while, though it may be two or three months before there is any appreciable improvement.

Messrs. Harland & Wolff.—Since last month's notes were published the Queen's Island firm has completed and despatched from Belfast the Bibby liner *Leicestershire*, of which full particulars appeared in a former issue of The Marine Engineer. The propelling machinery consists of two sets of quadruple-expansion engines of the balanced type, and these worked with marked smoothness on the trial trip. The departure of this vessel leaves Messrs. Harland & Wolff without any new tonnage afloat. There will, however, shortly be launched from the south end of the yard another new steamer for the Royal Mail Steam Packet Company's service in the West Indies—a sister-ship of the *Berbice*, recently built for the same trade. This end of the Queen's Island is particularly bare looking at present, but another keel has been laid, and a busier appearance will be presented in the near future. At the north end of the yard good progress is being made with the two big White Star boats: a considerable portion of the *Olympic's* after body is now in frame. When work at these vessels is further advanced employment will be afforded to a considerable number of men who are at present idle. Messrs. Harland & Wolff have had the torpedo-boat destroyer *Gipsy* in graving dock for repairs rendered necessary through going on the rocks on the Wigtownshire coast. In addition to the hull being damaged, both propellers were smashed, and the necessary repairs were carried out in an expeditious manner, the vessel being only five days in hands.

Messrs. Workman, Clark & Co. have at present five new vessels afloat the Orient liner *Orvieto*, Messrs. J. P. Corry & Co.'s *Star of Japan*, the Lloyd Brazilleiro boat *Rio Janeiro*, and the Tropical Fruit Steamship Company's two steamers *Almirante* and *Santa Marta*. The last-named vessel was launched in September, and is the tenth vessel built by Messrs. Workman, Clark & Co. for the same owners. In the way of repairs they have had the Lord liner *Lord Lansdowne* in hand for some time past for extensive repairs. The Italian liner *Ancona*, built by them, has also been here for a couple of weeks for repairs, and her sister-ship, the *Verona*, is expected in Belfast shortly for similar repairs. The resumption of work on the Lloyd Brazilleiro vessels, to which reference was made in last month's issue, has given employment to a considerable number of extra hands.

Messrs. MacColl & Co.—The Wigan Coal and Iron Company's new steamer *Balniel II.*, which has been built by the Dublin Dockyard Co., and engined by Messrs. MacColl and Co., underwent a series of successful trials in Belfast Lough at the beginning of the month. The trials were run with the vessel fully loaded, and, in addition to progressive trials, a continuous four hours' full power run was made. The vessel was designed by Mr. James Maxton, of Belfast, and is an up-to-date collier in every respect.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Holtby.—On July 5th, Messrs. Ropner & Sons, Ltd., Stockton-on-Tees, launched from their shipbuilding yard a steel screw steamer of the following dimensions, *viz.*:—Length, 358 ft. 6 in.; breadth, 50 ft. 10 in.; depth, 25 ft. 6 in. The vessel is built to the highest class in the British Corporation Registry, She will be fully equipped with an up-to-date outfit, including quick warping steam windlass, stockless anchors, steam-steering gear amidships and powerful screw gear aft. The appliances for loading and discharging cargoes expeditiously are very complete and include nine steam winches, double derricks to each hatch, steam being supplied by a large donkey boiler working at 100 lbs. pressure per square inch. The engines will be of the triple-expansion type by Messrs. Blair & Co., Ltd., Stockton-on-Tees, of about 1500 I.H.P., having two steel boilers 16 ft. by 10 ft. 6 in., 180 lbs. steam pressure.

Harpeake.—On July 5th, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Harpeake*, which they have built to the order of Messrs. J. & C. Harrison, Ltd., London. She will take the highest class in Lloyd's and is of the following dimensions, *viz.*:—Length, overall, 396 ft. 6 in.; breadth, 53 ft., and depth, 29 ft. The hull is built with deep frames, clear holds, cellular double bottom and large aft and fore peak ballast tanks, nine steam winches, return exhaust and winch condenser, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead, and ventilation sufficient for the Eastern trade. Electric light throughout, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 26 in., 42 in. and 70 in., with a piston stroke of 48 in., and two large steel boilers for a working pressure of 180 lbs. per square inch. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the bunkers and their "Bitumastic" covering to the tank tops in engine and boiler rooms.

Trelissick.—On July 6th, there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, a steel screw steamer built to the order of Messrs. Edward Hain & Son, St. Ives, and named the *Trelissick*. She is of the improved single-deck type to Lloyd's highest class, having poop, long bridge and topgallant forecastle; with deep girder framing, and having cellular double bottom all fore and aft, and with large after peak tank for water ballast. The outfit of the ship is very complete for general and grain trades, with shifting boards all fore and aft, and trunk feeders at hatchways. A full equipment of steam winches and derricks are fitted for the rapid loading and discharging of cargoes. The vessel has been built to carry a deadweight cargo of over 7000 tons on a light draught of water. The vessel will be fitted with triple-expansion engines, also constructed by Messrs. John Readhead & Sons, Ltd., having cylinders $25\frac{1}{2}$ in., 42 in. and 69 in. and 48 in. stroke, supplied with steam from two large steel boilers working at a pressure of 180 lbs. per sq. inch.

Macquarie.—On July 7th, Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull, launched from their yard a finely modelled twin-screw passenger and cargo steamer built to the order of Messrs. N. Cain Coastal Co-operative Steam Shipping Co., Ltd., of Sydney, Australia. Her principal dimensions are:—Length, 160 ft.; breadth, 29 ft.; depth, 9 ft. 6 in. moulded. She is constructed of steel to Lloyd's classification "A1 coasting service," and to Board of Trade latest regulations. She has been specially designed for light draught and is intended to trade between Sydney and Port Macquarie. The vessel is fitted with refrigerating plant, and a large portion of the after hold has been insulated for the carriage of butter in boxes. She has two pole masts with specially strong derricks and cargo gear, two steam winches (one of which is of patent slewing type), steam windlass, combined steam and hand-steering gear, also a complete installation of electric lights and bells. The machinery consists of two sets of triple-expansion engines, having cylinders 11 in., 18 in. and 30 in. diameter by 18 in. stroke. Steam is supplied by one extra large cylindrical boiler working at a pressure of 180 lbs. per square inch. Messrs. Wailes, Dove & Co.'s "Bitumastic" cement, enamel and solution was applied to the bottom and floors fore and aft, also internal surfaces of side and cross bunkers.

Annaberg.—On July 5th, Messrs. Swan, Hunter & Wigham Richardson launched at Newcastle the steamer *Annaberg*, which is being constructed for the service between Europe and Australia of the Deutsch-Australische Dampfschiffahrts Gesellschaft, of Hamburg. The steamer is built of steel, to attain the highest class in Lloyd's Register. She is over 600 ft. in length by $52\frac{1}{4}$ ft. beam, and is designed to carry over 7000 tons deadweight on a light draught of water. She will be fitted with triple-expansion engines, supplied with steam from three boilers working under forced draught, all being constructed at the Neptune Works. The auxiliary machinery for working the ship herself and for loading and discharging the cargo are of the most modern and improved type.

Rubio.—On July 6th, Messrs. Robert Thompson & Sons, Ltd., launched from their Southwick Yard, a finely modelled steel screw steamer, built to the order of Messrs. The Orders and Handford Steamship Co., Ltd., of Newport, Mon. She will take the highest class in Lloyd's, and is constructed on the deep frame principle with one deck, leaving the holds clear of all obstructions. Her principal dimensions are:—Length B.P., 290 ft.; breadth, 46 ft., and depth moulded 22 ft., and the erections consist of bridge 74 ft. There are four large hatchways arranged for rapid loading and discharging, each worked by powerful steam winches of heavy Liverpool type by Messrs. John Lynn & Co., Ltd., steam being supplied from multitubular donkey boiler by Messrs. Cochran & Co., Annan, Ltd., quick-warpnig steam windlass by Messrs. Emerson, Walker & Thompson Bros., Ltd., and steam-steering gear by Messrs. Donkin & Co. The engines are by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders $21\frac{1}{2}$ in., 36 in. and 59 in. by 39 in. stoke, with extra large boilers of 180 lbs. pressure.

Woodmere.—On July 8th, Messrs. the Blythe Shipbuilding and Dry Docks Co., Ltd., launched from their shipbuilding and graving works dock the fine steel screw steamer *Woodmere*, built to the order of Messrs. Falconer, Ross & Co., Newcastle-on-Tyne. This vessel, which measures 193 ft. 8 in. overall with a beam of 26 ft. 6 in., has been constructed under Lloyd's special survey to class 100 A1. She is of the raised quarter-deck type, having short bridge and topgallant forecastle. The *Woodmere* is specially adapted for the coal trade, having extra large self-trimming hatches, and will be fitted with an equipment of deck machinery and discharging gear of the most modern type. Triple-expansion engines will be supplied and fitted by Mr. G. T. Grey, of South Shields. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Heatherside.—On July 16th, Messrs. Short Brothers, Ltd., launched from their shipbuilding yard at Pallion, Sunderland, the steamship *Heatherside*, built to the order of the Charlton Steam Shipping Co., Ltd. The vessel, which will take the highest class at Lloyd's, is:—325 ft. in length, 47 ft. beam, 23 ft. $\frac{1}{2}$ in. depth moulded, and is designed to carry a cargo of 4800 tons on a moderate draught of water. Six steam winches, steam windlass, steam-steering gear amidships with rods and chains to quadrant and controlled from standards on flying bridge are fitted, all driven from a large donkey boiler fitted on main deck. Hand-steering gear fitted aft. The propelling machinery is by Messrs. John Dickinson and Son, Ltd., Sunderland, and consists of engines with cylinders 23 in., 38 in., 62 in. diameter with a stroke of 42 in., driven by two large multitubular boilers working at 180 lbs. pressure.

Miranda.—At Southampton was launched a large steam yacht, named *Miranda*, which has been built for Lord Leith, of Fyvie. The vessel, which is built of steel, is 220 ft. in length overall, and 190 ft. on the water line. The contract speed will be 14 knots on a draught of 13 ft. The Thames Yacht measurement will be about 1000 tons. The machinery consists of two sets of triple-expansion surface-condensing engines, with cylinders $14\frac{1}{2}$ in., $23\frac{1}{2}$ in. and 38 in. in diameter by 24 in. stroke. The work throughout is to Lloyd's 100 A1 class.

Polvarth.—On July 14th, there was launched on the Wear a steel screw cargo steamer named *Polvarth*. The vessel is being built to Lloyd's highest class under special survey, and is owned by the Polvarth Steamship Co., Ltd. She will carry 5350 tons on 20 ft. 6 in. The triple-expansion engines are by the North-Eastern Marine Engineering Co., Ltd., having cylinders 23½ in., 39 in. and 64 in., with a stroke of 42 in., and a working pressure of 180 lbs.

Edenmore.—On July 19th, Messrs. Richardson, Duck and Co., launched from their yard a finely modelled steel screw steamer of the following dimensions:—Length overall, 375 ft.; breadth extreme, 48 ft. 9 in.; depth moulded, 26 ft. 8 in.; gross tonnage, about 3650 tons. This vessel, which has been built to the order of Messrs. Wm. Johnston and Co., Ltd., of Liverpool, will take the highest class in the British Corporation Registry, and has been built under special survey. She is of the single-deck type with a tier of main-deck beams on which a sparred wood deck will be fitted. A cellular double bottom throughout and peaks are fitted for water ballast, and equipment includes electric light throughout, six steam winches and auxiliary boiler, double derricks throughout, including two 10-ton and one 20-ton derricks, derrick tables and cross trees on masts, steam windlass with quick-warping ends, stockless anchors, steam steering gear, etc., etc. The engines by Messrs. Geo. Clark, Ltd., Sunderland, have cylinders 24 in., 40 in., 67 in. by 45 in. stroke, steam being supplied by two main and one auxiliary single-ended boilers having a working pressure of 18 lbs.

Shonga.—On July 19th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, launched from their harbour dockyard the handsome steel screw steamer *Shonga*, built to the order of Messrs. Elder, Dempster and Co., Liverpool. The following are the dimensions and description:—Length, 355 ft.; beam extreme, 46 ft. and 25 ft. 3 in. depth moulded, to upper deck, classed 100 A1 at Lloyd's. The vessel is divided by six transverse bulkheads into seven water-tight compartments. Every attention has been paid to all appliances for the rapid loading and discharging of cargo, the vessel having ten powerful steam winches of the builder's own design, and ten derricks capable of lifting five tons; provision is made on each mast for a special derrick capable of lifting fifteen tons, whilst the whole of the mast arrangement is strengthened to lift forty tons. Very large patent up-cast and downcast ventilators have been fitted to each hold and 'tween deck. Two large lifeboats are fitted, together with six surf boats of special design built for carrying palm oil, etc., through the surf, Messrs. Elder, Dempster & Co. doing a very large business in this line. A complete installation of electric light is fitted by Messrs. Campbell & Isherwood, of Liverpool. Steam steering gear is placed amidships with leads aft to quadrant led alongside the hatches, quick-warping windlass forward and large multitubular donkey boiler of ample capacity for the supply of steam to the deck auxiliary machinery. The engines are of the triple-expansion type by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 25 in., 40 in., 67 in. by 45 in. stroke, with two boilers 16 ft. 6 in. by 10 ft. 9 in., working at a pressure of 180 lbs. per square inch and capable of driving the vessel at a fair rate of speed loaded. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel has been applied to vertical surfaces of boiler-room tank and their "Bitumastic" covering on the tank top.

Appenine.—On July 20th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., launched from the Middleton Shipyard, Hartlepool, the steel screw steamer *Appenine*, built to the order of the Gulf Line, Ltd., of London and Greenock. The *Appenine* is 360 ft. in length by 51 ft. by 25 ft. 6 in. depth moulded, carrying over 6300 tons on the light draught of 21 ft. 5 in. The vessel is of the single-deck type having absolutely clear holds, with poop, bridge and forecastle and is built to the highest class under British Corporation Registry. She is constructed with deep frames and longitudinal stringers giving clear holds for the storage of bulky cargoes, and is divided into six water-tight compartments by means of five water-tight bulkheads. Wood grain divisions are fitted throughout the holds according to the latest Board of Trade requirements. Four extra large cargo hatches are provided, with six powerful steam winches worked from a multitubular donkey boiler. A powerful quick-warping steam windlass is fitted forward, and steam-steering gear amidships, with hand-screw gear aft. The engines are of the triple-expansion type by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, having cylinders 25 in., 40 in., 67 in. by 45 in. stroke with two boilers 16 ft. by 10 ft. 6 in., working at a pressure of 180 lbs. per square inch.

Barmoor.—On July 20th, there was successfully launched from the shipbuilding yard of Messrs. Wood, Skinner and Co., Ltd., Bill Quay-on-Tyne, a new steel screw steamer which has been built by them to the order of Messrs. The Burnett Steamship Co., Ltd., Newcastle-on-Tyne. She is of the long raised quarter-deck type with long bridge and topgallant forecastle, and is provided with water in the cellular double bottom all fore and aft and in the fore and after-peak tanks. The vessel has specially large hatches for self-trimming and will be fitted with the latest improvements and appliances for facilitating the rapid loading and discharging of cargo. The machinery has been constructed and will be fitted by Messrs. The North-Eastern Marine Engineering Co. Ltd., Wallsend-on-Tyne, and consists of a set of triple-expansion engines supplied with steam by two large steel multitubular boilers.

Regis.—On July 31st, Messrs. S. P. Austin & Son, Ltd., launched from their shipbuilding and repairing establishment at the Wear Dock Yard, Sunderland, the steel screw steamer *Regis*, to be classed 100 A1 in Lloyd's Register under special survey and built to the order of Messrs. Stephenson Clarke and Co., of London, this being the sixth vessel constructed by them for the same owners. She is designed to carry about 2,100 tons deadweight on a light draught of water, and is fitted with large hatchways, specially adapted for the owners' coal trade. The machinery will be supplied by the North-Eastern Marine Engineering Co., Ltd., and the deck machinery, including steam windlass and steam winches, by Clarke, Chapman & Co., Ltd., and steam-steering gear by Davis & Co., Ltd., will be supplied with steam from a Blake Multitubular Donkey Boiler.

Gladstone.—On August 3rd, Messrs. Ropner & Sons, Ltd., of Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*:—Length, 378 ft. 6 in.; breadth, 53 ft.; depth, 27 ft. 3 in. The vessel is built to the highest class in the British Corporation Registry to carry about 7,000 tons. She is for foreign account, and is fitted with the builder's patent unproved trunk deck, with two large, clear holds and two only large hatchways, one being 82 ft. long by 26 ft. wide, and the other 67 ft. long by 20 ft. wide, thus facilitating rapid loading and discharging. The vessel is built on the deep frame principle, the frames being of bulb angle steel, and the holds are clear of all obstructions to the stowage of cargo, there being no hold beams or wide stringers. She has capacity for about 1,500 tons of water ballast in her cellular bottom and peak tanks. Her measurement capacity is exceptionally large, and she is fitted with nine powerful steam winches working in conjunction with ten derrick posts arranged in pairs, with wire runners and purchase spans. Steam is supplied to the deck machinery by a large horizontal multitubular boiler 11 ft. by 10 ft. The outfit includes stockless anchors, quick-warping steam windlass, steam-steering gear amidships and powerful screw gear aft. The engines are of the triple-expansion type by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, of about 1,800 I.H.P. on a very full specification, with boilers 10 ft. 9 in. by 11 ft. 6 in., working at a pressure of 180 lbs. Messrs. Wailes, Dove and Co.'s "Bitumastic" enamel has been applied to the bunkers, and "Bitumastic" covering to the tank top in engine and boiler spaces.

Queen Eugenie.—On August 4th there was launched on the Tyne a steamer named *Queen Eugenie*, which has been built to the order of Messrs. Thos. Dunlop & Sons, of Glasgow. The steamer is 395 ft. long by 49 ft. 9 in. beam by 29 ft. deep, and has been built under special survey to the highest class at Lloyd's. The machinery will be supplied by the North-Eastern Marine Engineering Company (Limited), Wallsend, consisting of engines with cylinders 24½, 40, and 68 in. by 48-inch stroke, three large steel boilers 14 ft. 6 in. by 11 ft., 180 lbs. pressure. The vessel will carry about 7,300 tons deadweight on the light draught of 23 ft. 8 in. and steam about 10 knots speed loaded at sea.

Lombard.—There was launched, on August 5th, from the shipyard of Messrs. Cochrane & Sons, Shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal

dimensions being 128 ft. by 22 ft. by 13 ft. 4 in. moulded. The vessel has been built to the order of Messrs. The Lindsey Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. Amos & Smith, Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Bruxellia.—On August 4th, Messrs. Short Brothers, Ltd., launched from their shipbuilding establishment at Pallion, Sunderland, the s.s. *Bruxellia*, built to the order of Messrs. T. Nelson & Sons for the Ghent Lloyd of Ghent. The vessel which will take the highest class in Germanischer Lloyd's is:—292 ft. in length; 41 ft. beam; and 20 ft. 7½ in. depth, moulded; and will carry a cargo of 3,600 tons on a moderate draught of water. She is constructed on the deep frame principle, with one deck laid, long poop, and topgallant forecastle, and the fore end is specially strengthened, enabling the vessel to steam through ice. Water ballast is provided for throughout the double bottom and in both fore and aft peaks. Five steam winches, steam windlass, steam-steering gear amidships, with rods and chain to quadrant and controlled from standards on upper and lower flying bridges are fitted, all driven from a large donkey boiler in stokehold. Hand-steering gear aft fitted. The propelling machinery is by the North-Eastern Marine Engineering Co., Ltd., Sunderland, and consists of engines with cylinders 21, 33, 55 in. diameter, and a stroke of 36 in. driven by two multitubular boilers working at 180 lbs. pressure.

Char.—On August 14th, the steel lighter *Char*, built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyards, Middlesborough, was successfully launched. This vessel has been constructed to the order of the Rea Transport Co., Ltd., of London, Managers, Messrs. R. & J. H. Rea, Liverpool, for their extensive coal trade. Her leading dimensions are 125 ft. by 24 ft. by 12 ft. 6 in. moulded, and she will carry about 550 tons deadweight. She is equipped with two steam winches specially designed for this class of trade, and windlass, this machinery being worked by a Cochran (Annan) donkey boiler.

Lancer.—On August 16th, there was launched from the yard of the Tyne Iron Ship-Building Co., Ltd., of Willington Quay-on-Tyne, a steel screw steamer built to the order of Messrs. Fisher, Renwick & Co.'s Manchester-London Steamers (1908) Ltd., and of the following dimensions, *viz.*:—Length, about 240 ft.; breadth, 34 ft.; depth, moulded, 24 ft., and to class A1 at Lloyds on the awning deck rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including three double-cylindered steam winches, and three "Walters" patent slewing engines for working cargo, direct-acting steam windlass, large Blake's patent donkey boiler, steam-steering gear by Messrs. Donkin & Co., and Donkin's screw gear aft. The engines, which are to be supplied by Messrs. North-Eastern Marine Engineering Co., Ltd., of Wallsend, are of the triple-expansion type, having cylinders 18in., 30in. and 49 in. by 33 in. stroke, and working at a pressure of 180 lbs.

Tortona.—On August 18th, Messrs. Swan, Hunter, and Wigham Richardson, Ltd., launched at their Wallsend shipyard the twin screw steamer *Tortona*, for the fleet of the Cairn Line of Steamships, Ltd., of Newcastle and Dundee, for their Canadian service. This vessel is a finely-modelled four-masted twin-screw steamer with complete shelter deck; 464 ft. overall length; 54 ft. 2 in. beam, and 40 ft. deep to the shelter deck, and has a gross tonnage of about 7,600. She has been built to the highest class at Lloyd's and to the regulations of the British Board of Trade, American and Italian Emigration Laws, and has accommodation for thirty-seven first class and 1,082 third-class passengers. The first-class passengers are accommodated in large state-rooms on the bridge and shelter decks. The first-class dining saloon is amidships on the shelter deck, and a tastefully arranged ladies' room, and smoke room are built at the fore end of the bridge, with access from the entrance house. The forward and after portions of the shelter 'tween decks and the two after compartments of the main 'tween deck form the third class sleeping quarters. There are three third-class dining rooms placed amidships under the shelter deck. To provide easy access to the third-class accommodation a specially large number of ladders and emergency ladders have been provided, the space at the foot of each being kept free. As the vessel will carry a deadweight of 8,300 tons, the arrangements for handling the cargo have been made very complete. There are fourteen derricks of sizes to lift from five to twenty tons, and there are twelve steam winches made by Clarke, Chapman & Co., of Gateshead. Part of the cargo which the vessel will bring from Canada being of a perishable nature, a large portion of 'tween deck space has been insulated, and will be cooled to a temperature of 40 degrees Fahr. on the cold air system, and further chambers of insulated space will be cooled to 15 degrees on the brine pipe system. The ventilation of the ship has received special consideration, the natural ventilation being assisted by numerous sirocco fans. The steering gear at the extreme after end of vessel is of the Wilson-Pirrie type, actuated by a telemeter from the wheel-house amidships. There is a complete installation of electric lighting and steam heating throughout the vessel, and fire-extinguishing pipes are led to all the holds. Two large deep ballast tanks have been fitted, and she will be supplied with a complete system of wireless telegraphy. Crew of 140 persons will be carried. The propelling machinery, which is being constructed by Palmer's Shipbuilding & Iron Co., Ltd., of Jarrow, consists of two sets of triple-expansion surface condensing engines, with cylinders 25½ in., 41 in., and 68 in. diameter, and a stroke of 48 in. There are four single-ended boilers, having in all sixteen furnaces and a heating surface of 13,200 sq. ft. The service speed of the s.s. *Tortona* will be considerably in excess of the Italian Government's requirements.

LAUNCHES—Scotch.

Inchcolm.—On August 17th, there was launched at Leith a steel screw coasting steamer, which has been built to the order of Messrs. A. F. Henry & Macgregor, of that port. The vessel, which was named *Inchcolm*, is of 100 tons gross. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Strathesk.—On August 27th, the *Strathesk*, a finely-modelled screw steamer, built to the order of Messrs. Burrell & Son, Glasgow, was launched at Greenock. The vessel has been constructed to the British Corporation highest class, and has holds specially arranged for quick stowage and handling of cargo. Dimensions:—Length, 390 ft.; breadth, 52 ft. 3 in.; depth, 28 ft. She will be able to carry a deadweight of 7150 tons on a draught of 23 ft., the gross tonnage being 4400.

Strathbeg.—On August 30th, there was launched at Port Glasgow a steamer, which has been built to the order of Messrs. Burrell & Son, of Glasgow. The vessel has a deadweight of 7130 tons, and is of the following dimensions:—Length, 390 ft; breadth, 52 ft. 3 in.; depth, 28 ft. She has a capacity in the double bottom and deep tank for 1850 tons of water ballast. The vessel, which has been built under special survey of the British Corporation for their highest class, has the holds specially arranged, with four large pillars in each, thus doing away with the usual stanchions. Her machinery will consist of a set of triple-expansion engines, having cylinders 25 in., 41 in. and 68 in. in diameter by 48 in. stroke.

Armadale.—On Sept. 14th, Messrs. Charles Connell & Co., Scotstoun, launched a steel screw steamer named *Armadale*, which they have built to the order of Messrs. Bethell, Gwyn and Co., London, for their Australian trade. The vessel has been built to Lloyd's 100 A1 highest class, and is fitted up for a limited number of first-class passengers. She is supplied with all the latest improvements for the rapid and efficient handling of cargo. Machinery of the most up-to-date type will be supplied by Messrs. David Rowan & Co., Glasgow.

Ourimbah.—There has been launched at Ardrossan a steel screw steamer, of 750 tons, built to the order of the North Coast Steam Navigation Company, Ltd., Sydney (N.S.W.). The vessel has been constructed to the special class of the British Corporation, and is fitted with all the latest appliances for the rapid handling of cargo. Messrs. Wailes, Dove and Co.'s "Bitumastic" enamel has been applied to the fore and after peaks, ballast tanks, chain lockers and bunkers, etc.

Masunda.—On Sept. 14th, Messrs. Alex. Stephen & Sons, Ltd., Linthouse, launched a large new cargo steamer for

Messrs. Maclay & McIntyre, Glasgow. Like her sister ship, the *Romera*, recently built by the Linthouse firm for the same owners, the vessel has been constructed to Lloyd's highest class, and her dimensions are :—Length, 403 ft. ; breadth, 52 ft. ; depth, 30 ft. She has been designed and fitted out as a first-class deadweight carrier. The machinery, which has also been supplied by the builders, consists of a set of triple-expansion engines, having cylinders 25 in., 41 in. and 67 in. diameter, with a stroke of 51 in., and supplied with steam from three large single-ended boilers, fitted with Howden's forced draught. Messrs. Wailes, Dove & Co.'s Bitumastic Enamel has been applied to engine and boiler room tanks and bunkers and their bitumastic covering to the tank top in boiler room.

Argus.—On Sept. 15th, Messrs. Ramage & Ferguson, Ltd., launched a steel twin-screw steamer which they have built to the order of the Honourable Corporation of Trinity House. This steamer is 170 ft. long, and has been fitted with all the most modern appliances for the service of Trinity House. The propelling machinery consists of two sets of triple-expansion engines, supplied with steam from two boilers working at a pressure of 180 lb. Messrs. Wailes, Dove and Co.'s " Bitumastic " enamel has been applied to the bunkers and boiler space, and their " Bitumastic " covering to the tank top in hold and thwart ship bunker.

Magallanes.—On Sept. 16th, Messrs. A. Rodger & Co., Port Glasgow, launched the steamer *Magallanes*, which they have built to the order of Messrs. Duncan Fox & Co., Liverpool. The vessel is of the following dimensions :—Length, 270 ft. ; breadth, 37 ft. ; depth, 21 ft., with a deadweight carrying capacity of 2000 tons. Accommodation is provided for thirty-two first-class, twenty second-class, and 200 third class passengers. Electric light is installed throughout, and all the cabins are fitted up with radiators, while a refrigerating plant has been provided and part of the hold is insulated in order to carry fresh provisions for the passengers. The *Magallanes* will trade in South American waters and will sail under the Chilian flag. The machinery will be supplied by the builders at their Govan works.

Burringbar.—There has been launched from the Grangemouth yard of the Greenock and Grangemouth Dockyard Co., Ltd., a steel screw passenger and cargo steamer, built to the order of the North Coast Steam Navigation Co., Sydney, N.S.W. The dimensions of the vessel are :—Length, 205 ft. ; breadth, 33 ft. ; and depth, 12 ft. Engines will be supplied by Messrs. Dunsmuir & Jackson, Glasgow. The vessel will be fitted with electric light throughout and also with refrigerator plant.

Beachy.—Messrs. Scott's Shipbuilding and Engineering Co. have launched at Greenock the steel screw steamer *Beachy*, built to the order of the Clyde Shipping Co. The vessel, which is intended for service in Eastern waters, has a carrying capacity of about 8000 tons, with a gross tonnage of 4900. Her dimensions are :—Length, 400 ft. ; breadth, 52 ft. ; depth, 29 ft. 7 in. (moulded). Engines will be supplied by the builders. The construction of the *Beachy*, which is the first of two vessels Messrs. Scott are building for the Clyde Shipping Co., has been accomplished in a remarkably short time, her keel having been laid only three months ago.

LAUNCHES—Irish.

Santa Marta.—On Sept. 14th, shortly before high water, Messrs. Workman, Clark & Co., Ltd., launched from their South Yard a further addition to the large number of steamers built by them for the Tropical Fruit Steamship Co., Ltd., Glasgow (Messrs. Clark & Service, managers). The *Santa Marta*, like her sister ship s.s. *Almirante*, at present approaching completion alongside the builders' finishing wharf, has been specially designed and constructed for the West Indian banana and general fruit carrying trade, and has accommodation for a large number of passengers. The public rooms and state-rooms are arranged to afford the maximum of comfort and pleasure to their occupiers, being handsomely decorated, luxuriously furnished and well lighted and ventilated throughout. The cargo holds are divided into eight compartments, all of which have been insulated and otherwise prepared for the carriage of fruit cargoes in bulk, these cargoes being kept in marketable condition by an efficient installation of refrigerating machinery. The vessel has been built under special survey for the highest class in the British Corporation Registry of Shipping, while the requirements of both the British Board of Trade and the United States Steamship Passenger Inspection Service have been fully complied with. The propelling machinery consists of a set of triple-expansion engines having steam supplied by five single-ended multitubular steel boilers working under forced draught, and constructed by the builders at their Queen's Road works, Belfast.

TRIAL TRIPS.

S. Paulo.—The new twin-screw passenger and cargo steamer *S. Paulo*, built by Messrs. Workman, Clark & Co., Ltd., Belfast, for the Lloyd Brazileiro of Rio de Janeiro, has undergone her speed trials. These were highly successful, a speed of about 14 knots being attained, which is considerably in excess of the guarantee. The vessel afterwards returned to Belfast for stores, and will leave for Rio de Janeiro in the course of a few days. The *S. Paulo* is about 354 ft. in length, with a gross tonnage of about 3600 tons, and is intended for passenger and cargo service on the Brazilian coast. Accommodation for about fifty first-class passengers is provided in handsomely appointed state-rooms. The space between the funnel and engine casings has been arranged as a comfortable lounge, lighted by a fine large skylight, and furnished with table and richly upholstered easy chairs and couches. Accommodation for a number of second-class passengers has been provided in a house on the poop deck, with a commodious dining saloon and comfortable staterooms, while the poop space has been arranged for the accommodation of one hundred and fifty third-class passengers. The four cargo holds are each provided with a large hatchway efficiently equipped with a couple of steam cranes capable of expeditiously dealing with a full general cargo. One of the 'tween deck spaces has been insulated and prepared for the reception of perishable goods and a large space has been suitably fitted up for the stowage of provisions required for consumption during the voyage. For the preservation of these goods and stores an installation of refrigerating machinery has been provided. The propelling machinery consists of two sets of improved triple-expansion engines with three steel cylindrical multitubular boilers working under forced draught ; the engines and boilers having been constructed in Messrs. Workman, Clark & Co.'s Queen's Road works, Belfast. The vessel has been built under special survey for the highest class in Lloyd's Registry, and complies with all the requirements of the British Board of Trade.

Woodmere.—On August 7th, the screw steamer *Woodmere*, built by the Blyth Shipbuilding and Dry Docks Co., Ltd., for Messrs. Falconer, Ross & Co., of Newcastle-on-Tyne, was taken to sea for loaded trial. The representatives of owners, builders and engineers on board were highly satisfied with the results obtained on vessel being run over the measured mile. The hull and machinery have been built under the supervision of Messrs. Havelock & Chaston, of Newcastle-on-Tyne. A Cochran (Annan) boiler with patent seamless furnace has been supplied and fitted. See also Launches.

Trelissick.—On August 11th, the new screw steamer *Trelissick*, built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of Messrs. Edward Hain & Son, St. Ives, Cornwall, was taken to sea on her official trial trip. The vessel was run several times over the measured mile, her machinery working very smoothly, and the trial giving every satisfaction to all concerned. The *Trelissick* is the fifty-first vessel built for Messrs. Edward Hain & Son by the above firm. She afterwards proceeded to Tyne Dock to load for the Mediterranean under the command of Capt. Blake. See also Launches.

Harpeake.—On August 12th, the handsome steel screw steamer *Harpeake*, built by Messrs. Wm. Gray & Co., Ltd., to the order of Messrs. J. & C. Harrison, Ltd., London, had her trial trip. The trial was witnessed by Mr. Wm. Crandell, of Messrs. C. M. Burls & Partners, consulting engineers, London, representing the owners, Captain J. E. Murrell, representing the shipbuilders, Mr. Maurice S. Gibb, the

engine builders, and Mr. Huffson, Lloyd's Registry, Captain Davie was in command. After adjustment of compasses the vessel was headed for the Tyne, her average speed on the run to the Tyne and back to Hartlepool being 11 knots, the engine running smoothly and to the satisfaction of all concerned. On the conclusion of the trial the vessel proceeded on her voyage. See also Launches.

Annaberg.—On August 12th, the new steamer *Annaberg* ran a very successful trial trip off the Tyne. The engines, on the triple-expansion system, together with the three boilers, which work under forced draught, have also been constructed at the Neptune Works of the builders, and on the trial trip worked without the slightest hitch, giving satisfaction to all concerned. Immediately on the conclusion of the trial the vessel left under the command of Captain Schutt. See also Launches.

Meltonian.—On August 17th, the new screw steamer *Meltonian*, built by Messrs. Harland & Wolff, Ltd., for the Wilson's and Furness-Leyland Line, Ltd., left Belfast and proceeded down the Lough for adjustment of compasses and trials. It is interesting to note that the *Meltonian* was engined, boilered and completed in twenty-five working days after her launch. After a satisfactory trial and adjustment of compasses the new vessel left for Liverpool in command of Captain Arthur Parker. The owners were represented at the trial by Mr. George Goldsworthy, Mr. Wm. Scott and Captain Lawrenson. See also Launches.

Appenine.—On August 21st, the steel screw steamer *Appenine*, the third vessel built and completed at the Middleton Shipyard, Hartlepool, under Sir Christopher Furness's co-partnery scheme, left the West Hartlepool Docks to undergo her official trial trip in Hartlepool Bay. The main and auxiliary machinery worked most efficiently throughout the trials, and has been supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, the sizes of the cylinders being 25 in., 40 in., 67 in. by 45 in. stroke, with two boilers 16 ft. by 10 ft. 6 in., working at a pressure of 180 lbs. per square inch. The trial was in every way satisfactory, the vessel easily maintaining a speed of 11½ knots, being the mean of several runs between the lights, a result which was extremely satisfactory to the owners' representatives on board.

Shonga.—On September 4th, this vessel proceeded on her official trial trip off Hartlepool. She has been built to the order of Sir A. L. Jones, K.C.M.G. (Messrs. Elder, Dempster and Co., Liverpool), by Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool. She is a sister ship to the s.s. *Winnebah*, launched from the same yard on Sept. 2nd. The *Shonga* was put through most exhaustive trials and on four runs on the Whitley Bay measured mile and one run from Hartlepool Heugh Light to Souter Point, a mean speed of 12 knots was obtained, the main engines and all auxiliaries working with complete satisfaction. The owners were represented by Mr. Craigie.

BOARD OF TRADE EXAMINATIONS.

Note—1C denotes First Class 2C Second Class.

August 20th, 1909.

Banks, F S .. 2C Liverpool
Beckwith, H J 1C London
Boswell, A F... 2C Cardiff
Brew, L S .... 2C Liverpool
Brown, G. P. F. 2C Glasgow
Burton, R R .. 2C South'ton
Bustin, F R. .. 2C London
Clarke, R .... 1C London
Dryden, E. J .. 2C N Shields
Drummond, G 2C Glasgow
Gardiner, R .. 1C Glasgow
Godfree, H .... 1C Cardiff
Graham, A .... 2C Leith
Hodgson, G. .. 2C Leith
Holmes, F G 2C W Hart'l
Hunter, A .... 2C Glasgow
Lambert, T M 1C N Shields
Linaker, F W 2C Liverpool
Linton, J M .. 2C Cardiff
Macfarlane, R 2C Glasgow
Macgregor, A J 2C London
M'Kay, D J .. 2C Glasgow
Malone, T N 1C Glasgow
Nicholls, F .... 2C South'ton
Pearce, H P... 1C Liverpool
Ritchie, D. J M 1C Leith
Ritchie, F. G .. 1C Leith
Robertson, T .. 2C Glasgow
Sangster, C C. 1C London
Simson, R W 1C N Shields
Stanley, S. .... 2C W. Hart'l
Thomson, J. A. 2C Leith
Waugh, R. W. 2C N Shields
Wears, J. S. .. 2C N.Shields

August 27th

Barlow, G .... 1C N Shields
Butler, R .... 1C London
Butterworth, R. 2C Bristol
Christiansen, F 2C Bristol
Davison, F..... 1C Sunderl'd
Davison, G. S 1C Sunderl'd
Downie, J .... 2C Greenock
Economides, D. 2C N Shields
Fitzjohn, C. W. 2C London
Frankum, A. V. 2C London
Graham, J. .... 2C N Shields
Gray, J H .... 2C N.Shields
McKellar, G. D. 2C Greenock
Main, T .... 2C Greenock
Marlow, T .... 2C Greenock
Milne, D. .... 2C Aberdeen
Mitchell, R. R. 2C Aberdeen
Montgomery, W 2C Greenock
Morton, J. .... 1C Greenock
Parkinson, R... 1C Sunderl'd
Porter, W. S... 1C Aberdeen
Potts, A. ...... 2C N.Shields
Potts, D D. .. 2C London
Read, G ...... 2C Sunderl'd
Rhind, G F. A 2C N Shields
Shaw, H....... 1C Greenock
Smailes, J .... 1C N.Shields
Spence, J .... 2C Greenock
Stott, F. .. .. 2C Sunderl'd
Thompson, C. 1C Sunderl'd
Took, D M. .. 2C Greenock
Watson, S.W W 1C N Shields
Weekes, F. T... 1C Sunderl'd
Wilson, A K .. 1C N Shields

September 2nd.

Alexander, W L. 1C Liverpool
Baker, F....... 2C N Shields
Barnett, W. J 1C London
Bathgate, J. .. 1C N Shields
Baxter, J. G. B. 1C Belfast
Brown, N H... 2C Liverpool
Bowen, F. S .. 2C London
Cartwright, J... 1C N Shields
Chambers, N .. 2C N Shields
Corbitt, W .. 1C N Shields
Crozier, J T. .. 1C N Shields
Cumming, A. .. 2C Liverpool
Davies, T H... 2C Cardiff
Dodd, S. F..... 1C N.Shields
Downie, J .... 2C South'ton
Edwards, H. O. 2C Cardiff
Evans, A R .. 2C Cardiff
Evans, L. R. .. 1C N.Shields
Fishburn, S .. 2C Cardiff
Floyd, W .... 2C Cardiff
Gibbs, W. .... 1C N.Shields
Gray, J B. .... 1C N.Shields
Grinyer, H. J 1C South'ton
Hall, H F .... 1C Liverpool
Hill, R. H H. 1C Liverpool
Hollings, A. A 1C N Shields
Johnstone, A .. 2C Glasgow
Johnstone, J .. 2C Belfast
Jones, D. T .. 1C Cardiff
Jones, J ...... 2C Belfast
Jones, J R .. 1C Liverpool
Lea, J .... 2C Liverpool
Lemon, R. H... 1C Cardiff
M'Allister, ... 1C Glasgow
M'Call, R .... 1C Glasgow
M'Cullum, D W 1C Liverpool
M Donald, D. 2C Glasgow
Macmeikan, R A 1C London
Magahy, J .... 1C Belfast
Martin, W .... 1C Leith
Morrison, W .. 1C Glasgow
Newcomb, E .. 2C Liverpool
Ogilvie, J. G .. 2C N.Shields
Portway, R C. 1C London
Pringle, F H M. 1C Glasgow
Prophet, B..... 1C London
Reid, A. M..... 1C Cardiff
Reid, R. ...... 1C Liverpool
Roberts, H. L. 1C Falmouth
Robson, N. V. 1C N.Shields
Rogers, E. S .. 2C Cardiff
Sale, W. A .. . 1C Liverpool
Salter, A R .. 2C London
Seaman, W. .. 1C Cardiff
Shearer, G. H. 1C Liverpool
Simmons, J. J. 2C London
Swarbrick, R... 1C Liverpool
Symes, F. .... 1C Liverpool
Taylor, H. B .. 2C N.Shields
Thomas, W. .. 2C Liverpool
Thomson, P. G. 1C London
Waugh, J W H. 1C London
Wilkins, R .... 1C N.Shields
Wiseman, G. A 2C Cardiff
Wright, B. N 2C London
Wylie, R H. .. 1C N.Shields

September 9th.

Baker, A ...... 2C London
Cheldrake, E.M. 2C London
Ellison, J. H .. 2C Liverpool
Fisher, A .... 2C London
Macpherson, D. 1C N.Shields
Mansfield, A .. 2C London
Nichol, B .... 1C N.Shields
Nickson, A T 1C Liverpool
Sampson, T .. 2C Liverpool
Sanders, F. A. 2C London
Scott, D. ...... 1C N.Shields
Scott, R ...... 1C N Shields
Shepherd, C.W 1C London
Watson, W R 2C Liverpool
Wilson, J J. .. 1C Liverpool

September 16th.

Armstrong, G. 1C Greenock
Blake, L. J .... 2C N Shields
Bowden, W. .. 1C Dundee
Caffrey, C J. .. 1C Dublin
Campbell, D .. 2C Greenock
Campbell, G P A. 2C Liverpool
Cooper, N. R 2C Dundee
Cosman, E..... 1C Hull
Dagg, W....... 2C N Shields
Eckford, E. R. 2C London
Gilchrist, D .. 1C Greenock
Hampton, W... 1C Dundee
Hay, A. ...... 2C Greenock
Hunter, W P. 2C Dundee
Johnston, F. .. 2C Greenock
Keenliside, C... 1C Liverpool
Kennedy, J E. 2C Liverpool
Kirk, D ...... 1C Dundee
Lawson, C. A 1C London
Lea, H......... 1C Hull
Little, S ...... 1C N.Shields
Lord, P. T..... 1C London
Mervyn, A .... 2C London
Milne, J P..... 2C Dundee
Rennie, J M .. 1C Liverpool
Richardson, J.M 1C Greenock
Ritchie, J .... 2C Greenock
Robinson, J. W 1C N Shields
Robinson, Jos. 1C N Shields
Scott, C F .... 2C N Shields
Smith, F ...... 1C London
Sowden, E... 1C N.Shields
Stephenson, C N 2C N Shields
Stewart, P .... 1C Greenock
Thompson, W B. 2C London
Watkins, F M 2C Liverpool
White, R A .. 1C Dundee
Willison, L. B 2C Dundee

The Marine Engineer
And Naval Architect.
LONDON, NOVEMBER 1st, 1909.

THE ROYAL MAIL STEAM PACKET COMPANY.

FROM the point of view of historical interest the past month or so has marked events of more than usual importance. Our American cousins have been celebrating the three-hundredth anniversary of the discovery of the River Hudson and the running of Fulton's steamboat, the *Clermont*, and at about the same time, the Royal Mail Steam Packet Company on our side, have been commemorating the seventieth anniversary of their incorporation by Royal charter granted by Queen Victoria on September 26th, 1839. We venture to think that not only is the Company to be congratulated on its history and its effect on commerce, but the nation as a whole owes it a debt of gratitude for the part it has taken in developing our Colonies and in promoting trade in different parts of the world. The history of the Company comprises substantially the complete history of ocean travel as far as steam propulsion is concerned, for, starting with paddle steamers, their enterprise in 1849 in building a screw steamer gave them the position of being the first mail company to adopt the screw propeller. The Company was subsidized by the Government in 1840 to an amount of £240,000 per annum for carrying the mails, for which purpose a sufficient number (not less than fourteen) of good substantial and efficient steam vessels, of such construction and strength as to be fit and able to carry guns of the largest calibre used on board Her Majesty's steam vessels of war, had to be provided, maintained and kept seaworthy and in complete repair and readiness. As the Chairman of the Company humorously remarked at the dinner given on September 27th, it is doubtful if the mail steamers of to-day could carry the *Dreadnought's* guns. As time went on the subsidy was first increased to £270,000 and then gradually decreased until, in 1905, it ceased entirely, and a system of payment on the basis of poundage substituted. The Company started business on a fairly substantial basis, having nineteen steamers with a total tonnage of 29,000 tons, the largest vessel being a wooden paddle steamer of 2,000 tons; the Admiralty not having any faith in iron vessels insisted on the use of wood. The mileage covered by the fleet in the first year was 400,000. Compare these figures with those of to-day. The fleet consists of forty-nine vessels, having an aggregate tonnage of 210,000 tons, and the mileage covered last year was 2,750,000 miles, or seven times as much as the initial annual mileage. While the service was originally started to form a link between Great Britain and its West Indian Colonies, as time has gone on it has extended its connection to the great Republics of South America, to Australia, Mexico, Cuba, and the United States of America, while Morocco, China and Japan have in recent times been included in their sphere of operations. In connection with their Australian trade their largest boat, the *Asturias*, of 12,000 tons, was at the time of first passing through the Suez Canal the largest ship that had ever been through. While much of the recent progress of the Company is no doubt largely due to the chairman, Mr. Owen Phillips, it is acknowledged by that gentleman that much of the success is due to the loyal and energetic staff who work under him.

WORKMEN'S COMPENSATION

A GOOD deal of apprehension was expressed when the Workmen's Compensation Act of 1906 came into operation, as to the amount of money which was likely to be paid by shipowners. A blue book has just been issued containing statistics of proceedings under the Act during the year 1908. This record shows that compensation was paid in 371 fatal cases to the amount of £61,333, or an average of £165 per case, and in 5,877 disablement cases, £51,519, or an average of £8 15s. per case. It may be well to say the fatal cases include those in which the deceased left persons wholly dependent, and in which the compensation will not be less than £150, and may be as high as £300, and also cases in which he left persons only partially dependent on him, and in which the compensation is to be proportionate to the injuries of the said dependents. The average amount of compensation paid in respect of the 208 cases in which persons were left wholly dependent was £245; while in 136 cases in which persons were left partially dependent it was £76. The average charge during the year in the disablement cases, in which 507 were continued from the previous year, the amount worked out at about £15. The total number of seamen retained as being within the Act was roughly 23,500, of whom 215,000 were in steam vessels and 20,000 in sailing vessels, and the total compensation paid under all the heads averages out 9s. 7d. per head. It is pointed out that the total number of seamen registered under the Merchant Shipping Acts as employed in sea-going trading vessels belonging to the United Kingdom in 1908 was roughly 269,000, and the returns from the blue book fall considerably short of this total, a discrepancy which may be probably accounted for by the different bases upon which the figures are obtained. The registration figure for this is obtained by taking the number of the first crew engaged during the year, while the compensation figure is the average number employed during the year. Turning now to the returns made in respect of labourers working in connection with the harbour, dock, wharf or quay,

156 fatal cases were compensated with a total payment of £21,254, which is an average of £136 per case, while £65,220 was the amount paid in 10,591 disablement cases, or an average of £6 8s. 3d. per case. The average charge during the year was £17 per case, and on the figures given the compensation works out at £1 5s. per head. If the returns sent in by the employers are sufficiently reliable to form a basis of comparison, the results clearly show there is much less risk to those who work at sea than to those who work on shore, although one must not lose sight of the fact that the question of compensation to dependents is likely to be a larger amount per head on shore than to those afloat for various reasons of which it is not necessary to go into details at the moment. Looking at it from the employers' standpoint, there does not seem much ground for dissatisfaction on their part.

EFFECTS OF LABOUR DISPUTES ON TRADES.

To all those who take an intelligent interest in economics relating in particular to the industry of this country, we would strongly recommend a perusal of the speech made by Sir Charles Maclaren, M.P., when presiding at the annual meeting of Palmer's Shipbuilding & Iron Co., Ltd. It is clear that considerable difficulties have had to be contended with in carrying on their business operations during the past year. The prolonged strikes in all their departments had very seriously affected their trading results a year ago, and, although hopes were felt that they had got to the end of their troubles, events had unfortunately shown that the labour difficulty had played havoc with the commercial operations. He showed clearly that the baneful effects of strikes did not terminate with the men resuming employment, as disorganization always follows a strike, and before a normal state of things is reached, much lost ground had to be made up, and neither men nor masters could expect good results until matters assumed their normal state. As an example of how delay involved increased costs, he cited the case of the battleship *Lord Nelson*, which was on their hands nearly eleven months longer than it ought to have been, while three first-class torpedo boats for the Admiralty were some months longer in completing than had been estimated for. Assuming that the standing charges of so long a concern as Palmer's are kept as low as possible, it is clear that they constitute an important factor in effecting the ultimate result when manufactuing operations are seriously restricted and market prices are very low. It shows a serious state of things when no department of the work is more than half employed, and some not even that. Poor consolation is derived from the fact that contracts placed during the past year with competitors had been at prices never before reached in ship-building, and must in many instances have left the builder without any return. In 1908 there was a phenomenal drop in mercantile tonnage launched in the United Kingdom from 1,608,000 in 1907 to 930,000, or about 45 per cent. Surely the worker has had sufficient object lessons to appreciate the fact that his domestic economy is absolutely dependent on the prosperity of his employers' buisness, and that every effort made by him in disorganizing such business very much resembles killing the goose that lays the golden eggs. Security of the prosperity of national industry will never be fulfilled until the workers appreciate this important truth.

THE ARMOURED CRUISERS "BLÜCHER" AND "DEFENCE."

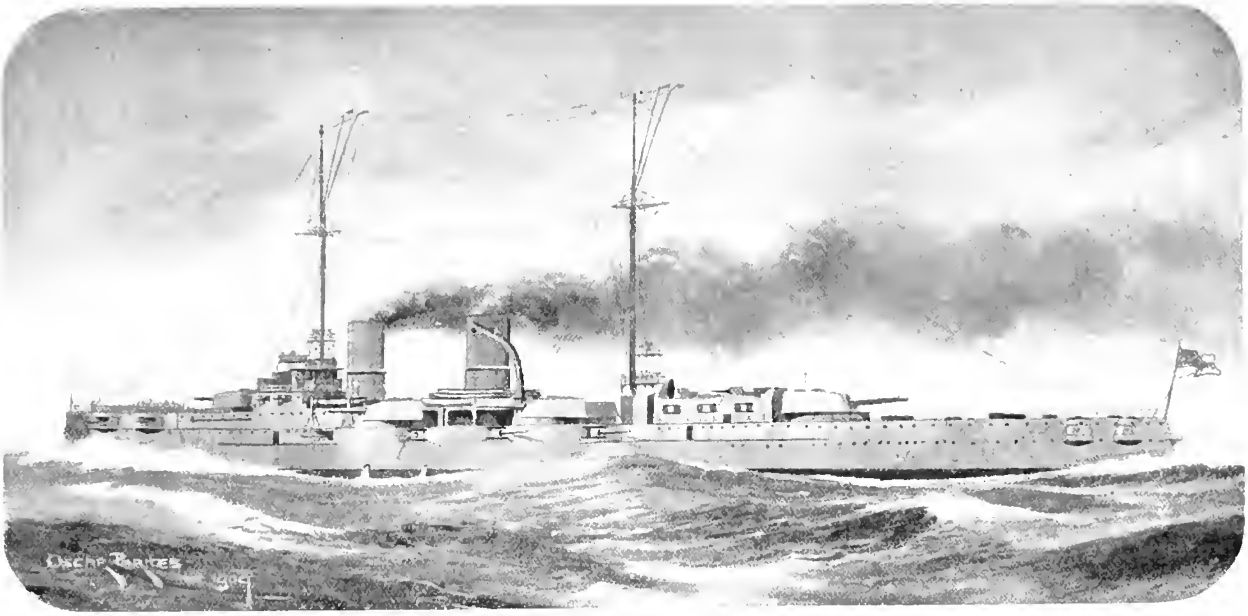
The veil of secrecy which for so long surrounded the construction of the new German armoured cruiser *Blücher* has now been lifted, and we are able to present herewith what we claim to be the first accurate illustrations of the ship that have appeared in the technical press of this or any other country. Our artist, Mr. Oscar Parkes, recently made a tour of the principal German dockyards and managed to obtain photographs of the *Blücher*, also *Westfalen*, *Posen*, and other ships of the *Nassau* class of "Dreadnought" (which we hope to deal with in our next issue), so that should the illustrations herewith differ in detail from the plans given in the leading naval annuals the charge of inaccuracy must be laid against the latter publications.

The construction of the *Blücher* is now generally regarded as a blunder on the part of the German Admiralty. Built as a reply to our *Invincible* class, she was credited with a baptismal armament of eight 11-in. guns, although no official details were made public. Now, when full particulars of her gun power are known, it is evident that her design was drawn up on the assumption that the *Invincible* class would carry ten 9·2-in. guns—the armament that was credited to them in the belief that they would be some natural evolution of the *Defence* class. Our own Admiralty kept the true calibre of the guns a close secret until close upon the time the *Indomitable* was launched, when it became known that her primary battery would consist of eight 12-in. guns. By then the construction of the *Blücher* was so far advanced that it was impossible to make any alterations in her design to permit of larger guns being carried, but so close was the secret of her armament kept that until comparatively recently she was classed as an "Invincible." Now the cat is out of the bag, and the German public are faced with the unpalatable truth that £1,340,000 has been expended on a cruiser which, far from being superior to our latest ships—as they were at first persuaded to believe—is really only on a par with the *Defence* class.

The following details of her dimensions and armament are official:—Length (w.l.) 507 ft.; beam 82 ft.; and draught 27 ft. Displacement 15,500 tons. Main battery, twelve 8·2-in. in six 6-in. turrets; secondary, eight 5·9-in. quick-firing guns in casemates amidships on the main deck; tertiary, sixteen 3·4-in. quick-firing guns in the bow, stern and superstructure. The secondary 5·9-in. battery was a quite recent innovation, as the original design was for twelve 8·2-in. and twenty 3·4-in. only; their inclusion means a decided gain in gun-fire, and although the "main-deck battery" is now regarded as obsolete in some quarters, there is no doubt that for use against torpedo-craft the 5·9-in. will be infinitely more effective than the 3·4-in. gun, although the limited height above water of the former pieces will greatly restrict their utility. In general design the *Blücher* resembles the big "Nassaus," having the same disposition of turrets and smaller guns, masts, funnels, etc., while the armoured area is in the same proportion. The belt is thin, being 6 in. amidships and 4 in. fore and aft, while the turrets and battery are covered with 6-in. steel. Of the internal protection nothing is yet known for certain, but rumour does not credit her with any very special con-

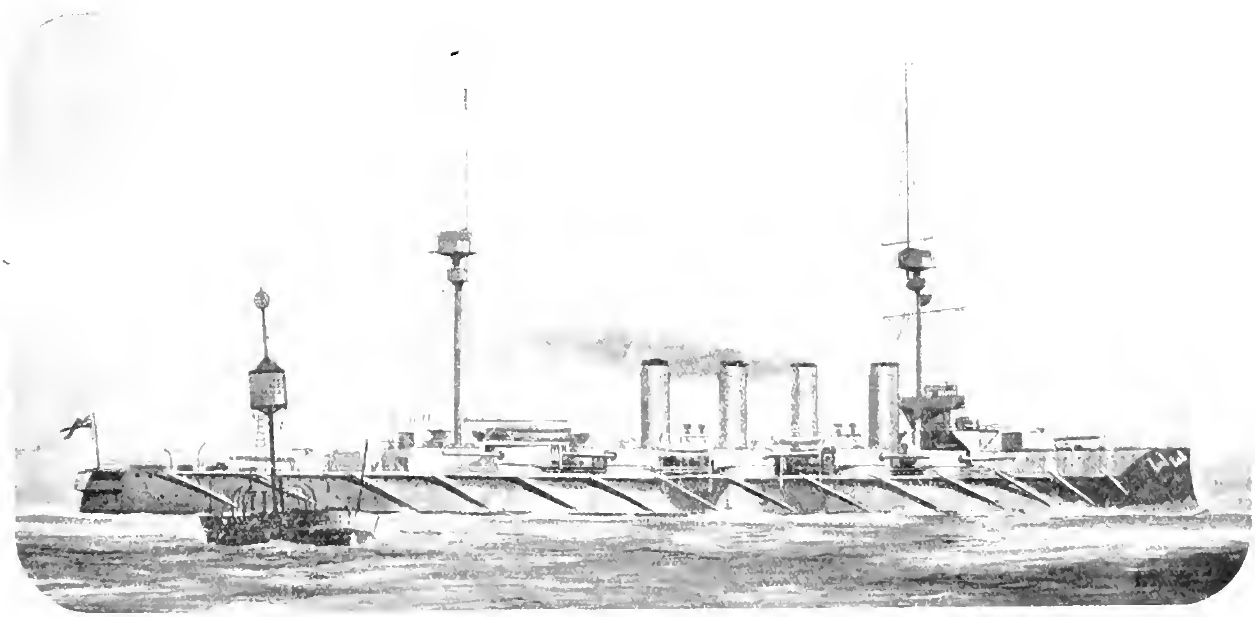
struction against torpedo attack. So much for what is known of her offensive and defensive qualities.

Owing to the tardy adoption of the turbine system of propulsion by the German authorities, the *Blücher* is further handicapped when compared with the "Invincibles," through



The Armoured Cruiser *Blucher*

her machinery being of the reciprocating type. This consists of three sets of vertical triple-expansion engines developing some 32,000 H.P., which is to give the ship a speed of 23·5 knots or thereabouts. There are three screws and the eighteen boilers are of Schulz Thornycroft design. The coal supply

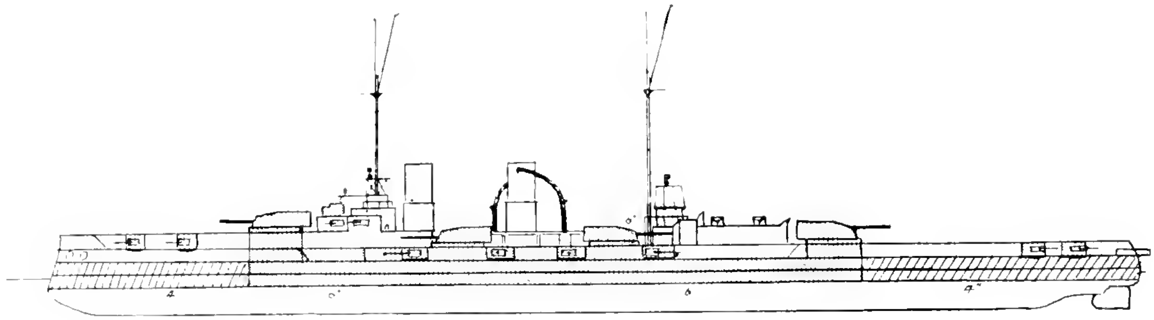


The Armoured Cruiser *Defence*

is good, consisting as it does of 1,000 tons normal and 2,000 tons maximum, plus 200 tons oil or exactly the same as that of the *Defence*, except that our ship carries just double the amount of oil.

As may be seen from our illustrations, the disposition of the gun turrets present no great peculiarity, and out of the twelve guns only six can be trained ahead or astern and eight on either beam. This same weight of fire could have been obtained with ten guns mounted after the *Dreadnought* fashion, or with eight like the *Invincible*, so that the *Blücher* actually carries at least a couple of guns that could have well been dispensed with and the weight put into armour or speed. German designers are now following the American model, and placing their guns along the centre-line with large training arcs on each quarter, so that the *Blücher* is likely to remain the sole cruiser example of her type in the German Navy; the larger *Von der Tann* will certainly carry 60 per cent. of her main armament in the centre-line, as she is reported to be a cruiser "Dreadnought" with her guns disposed like the English ship.

We have appended a plan and illustration of the *Defence* for comparative purposes, as being the only ship-type in our own fleet that can be compared with the *Blücher*. In displacement the *Blücher* has the advantage of nearly 1,000 tons, but for all that her broadside is not so heavy as that of the English ship, the discharges working out as follows:—



S.M.S. "BLÜCHER"

Defence	4	9·2 in.	380 lbs. shell	=	1,520 lbs.
Broadside	5	7·5 in.	200 ,,	=	1,000 ,,
					2,520 ,,
Blücher	8	8·2 in.	242 lbs. shell	=	1,936 lbs.
Broadside	4	5·9 in.	88 ,,	=	352 ,,
					2,288 ,,

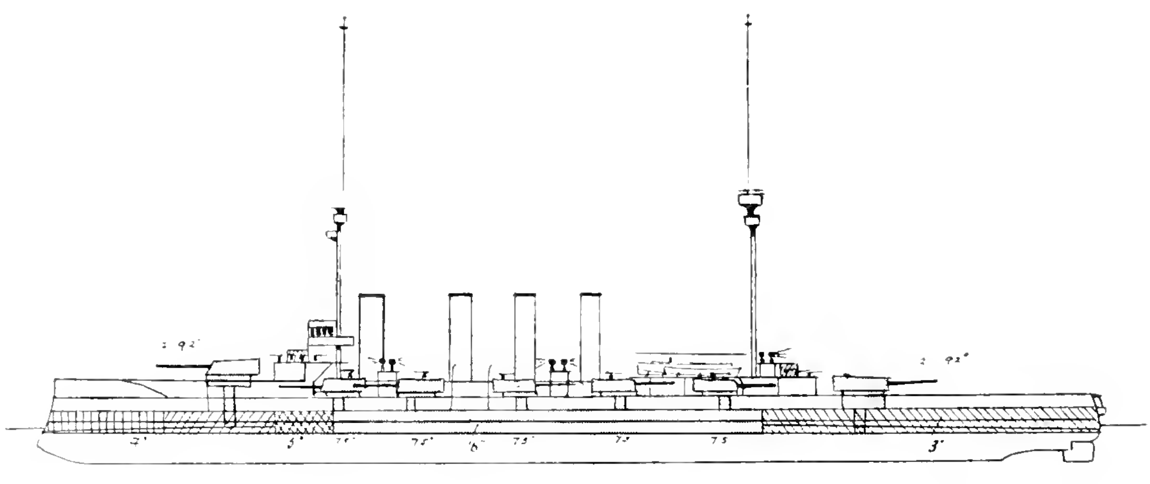
The rates of fire of the different guns are approximately, two-three rounds per minute for the 9·2-in., three for the 7·5-in., three for the 8-in., and seven for the 5·9-in. The English single mountings for the 7·5-in. will, however, permit of a better rate of fire being maintained than would be the case with the twin 8.2-in., so that as a matter of fact the *Defence* would be really at a bigger advantage over the *Blücher* than the figures for a single broadside show. Other details can be gathered and compared from the table below, while last, but not least, we have three "Defences" to pit against the solitary *Blücher*.

A word as to the appearance of the German ship. From an æsthetical point of view she is probably one of the ugliest war-vessels in existence, although there is an extremely utilitarian look about her. The funnels lack the usual tops, the big 5·9-in. gun embrasures on the main deck break the symmetry of the hull, while the gaunt cranes and general run of superstructure tend to accentuate the Philistine appearance of the ship. As regards rig, when seen at Kiel she had no wireless telegraphy gaffs up, but these were understood to be of the same pattern as those carried on the *Westfalen*, and have been drawn in accordingly. Their peculiar shape will be remarked on.

The *Blücher* is now commissioned for trials and will be ready to join the fleet within the next few months.

COMPARATIVE TABLE.

	Blücher.	*Defence.*
Launched	April, 1908	April, 1907
Dimensions	507 ft. × 82 ft. × 27 ft.	520 ft. × 74½ ft. × 28 ft.
Displacement	15,500 tons	14,600 tons
Guns	12 8·2-in.	4 9·2-in. 50 cal.
	8 5·9-in.	10 7·5-in. 30 cal.
	16 3·4-in.	14 3-in.
Torpedo Tubes	3 submerged	5 submerged
Armour Belt—fore, amid., aft.	4-in.—6-in.—4 in.	3-in.—6-in.—4-in.
Big Guns	6-in.	8-in.—6-in.
Secondary	6-in.	8-in.—6-in.
I.H.P.	32,000	27,000
Speed	23·5 knots	23 knots
Cost	£1,340,000	£1,362,070*



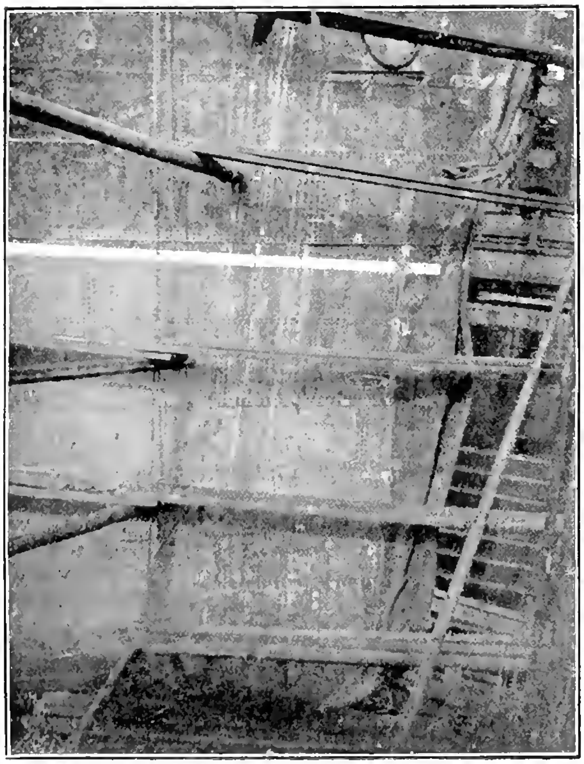
H.M.S. "DEFENCE"

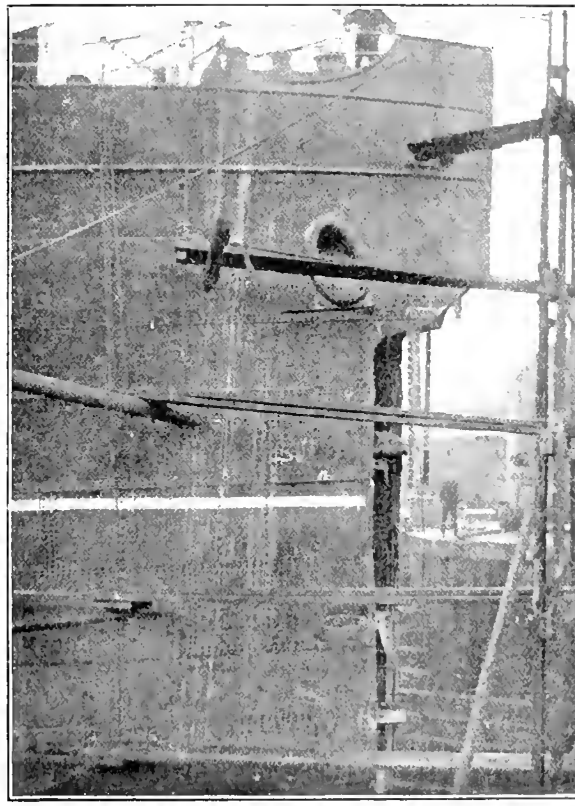
* Total cost raised through having twelve turrets against six in *Blücher*.

OXYGEN CUTTING IN SHIP REPAIR WORK.

THE cutting of metal by means of oxygen, and the process of welding and filling by the same means, are matters which have shown a steady development on the Continent of late years, and during the past two years decided advance has been made in this department of science as applied to the engineering industry in this country. The British Oxygen Company, Ltd., of London, Birmingham, Manchester, Newcastle and Glasgow, has demonstrated in many instances its ability to carry out work of this very special character, and the object of this notice is to call attention to the successful carrying out of a notable bit of practical work in ship repair at Glasgow. Incidentally it may be mentioned that this Company have recently taken over, and are now developing, the business formerly and for many years in the hands of the Scotch and Irish Oxygen Company, Ltd., of Rosehill Works, Polmadie, the field for expansion in regard to the employment of oxygen, in the cutting and welding of metals alone, amply justifying the step.

The special work referred to as having recently been carried out by this Company in Glasgow was the cutting away of the major portion of the stem and forefoot of the steamer *Tenasserim* belonging to Messrs. P. Henderson & Company's fleet of Indian traders. This vessel was damaged last month in collision with the Cardiff steamer *Segontien* in the Mersey and was put into the hands of Messrs. D. & W. Henderson, of Partick, for repair. She was docked in one of the Clyde Trust graving docks at Govan, and it was found that the damage she had sustained was so serious that practically a new bow would have to be fitted. Immediately behind the stem many of the plates were so badly buckled that the utmost difficulty was experienced in driving out the rivets, and the repairers eventually decided to have the stem and the buckled portions of the shell plating bodily cut away by the Oxy-Acetylene process of metal cutting. The British Oxygen Company were entrusted with the work.





S.S. *Tenasserim* in Dock, showing damaged stem and bow cut away by the Oxy-Acetylene Process

Accompanying this notice are two photos of the bow part of the *Tenasserim* in dock, one showing the buckled portions of the stem before cutting had been begun, and the other with the cut-out portion removed. The total length of cutting was about seventy feet, or about thirty-five feet on each side of stem. Single plates were ¾-inch thick, and of course double thickness was encountered where they overlapped. The stem itself was broken through at the top where the cutting commenced, but was intact at the forefoot, and the total thickness cut through there, including the plating on each side of stem, was 5½ inches. The workman entrusted with the cutting by the Oxygen Company completed the task in about a day and a half, but had the weather conditions not been so very unfavourable, and had he been more accustomed to working on scaffolding,

etc., the work could have been got through in one day.

The instrument or hand-cutter employed was of the type in which the two mixed gases—oxygen and acetylene discharge, on the metal being operated upon, through an annular opening in the end of the nozzle, while the extra oxygen which is used for the actual cutting issues through a separate passage in the centre of the nozzle. The oxygen and the dissolved acetylene employed were compressed in cylinders which lay at the bottom of the graving dock, the supply of gases being carried to the cutter through suitable lengths of flexible tubing. The operator carried out the work under the direction of Messrs. D. & W. Henderson's foremen, and it was freely allowed by them that had the work been put through by the ordinary method of cutting by hand and hammer it would have taken ten men about two days to accomplish it.

The Sir John Cass Technical Institute.—The introductory lecture to the courses on Fuel at the Sir John Cass Technical Institute was given by Mr. J. S. S. Brame, Lecturer on Fuel, on Monday, October 11th, when the chair was taken by Sir Boverton Redwood, D.Sc. Mr. Brame took as the title for his lecture

"Liquid Fuel and its Economic Aspects."

He said:—The use of liquid fuel for power purposes has within recent years attracted much attention in this country. It is only within comparatively recent times that great advances have been made in its utilization in internal combustion engines, a use which has had far-reaching results. The petrol engine is, of course, a pure liquid fuel motor, and the advances directly attributable to this one form of liquid fuel include the introduction of the motor car, the submarine for Naval purposes, and, lastly, led to the solving of those problems of flight which man has hoped to accomplish for many years. As a fuel for steam-raising, oils of high calorific value, cheapness and high flash point are demanded, whilst for internal combustion engines oils of high volatility are generally requisite in order that they may readily form explosive mixtures with air in the cylinder. For external combustion of oil fuels some spraying or "atomizing" device is now practically universally adopted, some systems depending on steam injection, others on air, and another type, which is rapidly finding extended use, especially for marine purposes, on the spraying action obtained through the oil being forced under pressure through suitable small orifices in the burner. The provision of a suitable spraying burner is, however, a matter of no great difficulty. To obtain complete and smokeless combustion great attention has to be paid to the furnace arrangements, and early troubles largely arose from lack of proper attention to this point. Smokeless combustion can now be ensured. Briefly, the advantages of liquid fuel over coal may be summarized as—superior evaporation to coal in the ratio of 1·6 to 1, ease of handling, facility it affords for stowing on ships in situations where coal could not possibly be stored, less space required than for coal, one ton of oil requiring only some 38 cubic feet, whilst coal requires some 43 cubic feet per ton. There are also numerous other minor advantages. The many advantages of liquid fuel have created such enthusiasm in its favour that the important questions of supply and prices have frequently been overlooked. The total oil supplies of the world, taking the figures for 1907, amounted to 34,569,500 tons, which in terms of coal, since it has such superior calorific value, would be equivalent to 51,854,250 tons of coal, or only one-fifth of the coal out-put of this country alone. Further, but a portion of the crude petroleum is suitable for fuel. Liquid fuel therefore cannot compete with coal, and is not a fuel for general use, but for employment in special cases. For Naval purposes most Powers are now following the lead given by Great Britain in its adoption. For use in internal combustion engines the lighter petroleum distillates are almost universally employed. Our annual importation of petrol has now reached the total of some 33,500,000 gallons. By the introduction of the spray carburettor a heavier grade of petrol can now be utilized, a factor of considerable economic importance as regards supplies. Further, since the calorific value of petrols of varying gravity is practically the same per unit weight (20,000 British Thermal Units) it follows that, as they are bought by volume, the heavier grades are more economical. Paraffin-driven motors are valuable engines for many purposes, notably where a portable engine is required, or for boats where safety is a factor of great importance. Paraffin engines work best at constant speeds, and are not suitable for cars. One important point with all engines using petroleum oils is that high compressions are out of the question, since at little over 4·5 atmospheres there is a risk of premature ignition, hence the efficiencies obtained are low. As petrol substitutes the claims of benzine (or benzol) and alcohol must be considered. Benzine is produced in very large quantities from both gas and coke-oven tar, and its present price is low, about 6½d. per gallon. The calorific value per unit weight is 18,540 British Thermal Units, but per unit volume, owing to its higher gravity, it has a higher value than many petrols. In practice benzol gives most excellent results without any special alteration of the carburettor designed for petrol, a 40-H.P. 6-cylinder Napier having covered 22·65 miles per gallon of benzol as against 18·14 miles on petrol. Slight trouble may be anticipated in very cold weather, but usually there is no difficulty in starting the engine if a little petrol is first got through the carburettor. Alcohol, the only fuel which we can actually manufacture from materials derived from other sources than coal, peat or petroleum, is of special interest. The importance of alcohol and the great aid which its production on a large scale would give to agriculture, has led to the possibilities of its use being carefully studied by Commissions in Germany, France and America. For motor use it has many advantages over petrol or benzine; it is far less inflammable, and if a fire does arise, it can more easily be extinguished, its combustion leaves no evil-smelling products, engines run more quietly on alcohol, and it will stand higher compressions in the cylinder, thereby giving such greater efficiency that the effect of its low calorific value is almost counterbalanced. For equal weights the calorific value of petrol to alcohol is 20,000 to 11,000 British Thermal Units, a ratio of 1·8 to 1, but if considered by volume, the ratio is reduced to 1·6 to 1. Since the thermal efficiency of alcohol is greater than petrol in the ratio of 3 to 2, it is evident that volume for volume the same power can be obtained from alcohol as from petrol. At present the cost of alcohol is prohibitive, and although in seasons when a heavy yield of raw material—chiefly potatoes—is obtained, the cost of production is comparatively low, yet with charges such as are necessarily imposed through Revenue supervision, quite independent of duty, it is unlikely that it can for many years reach the position of a commercial fuel. As pointed out by Professor Lewes, for use in submarines, alcohol would be an ideal fluid on account of its great safety, and, in order to obtain all possible security for those engaged on this dangerous duty, expense is a matter of very minor importance. The courses on Fuel, which include lectures on Liquid, Gaseous and Solid Fuel, and courses of laboratory work on Fuel Analysis and Technical Gas Analysis, commenced on Monday, October 18th. Full details of the classes may be had on application at the Institute.

Institution of Engineers and Shipbuilders in Scotland (Incorporated).—The first general meeting of the fifty-third session of the Institution was held in the Lecture Hall, at 39, Elmbank Crescent, Glasgow, on Tuesday, October 26th at 8 p.m. After the adoption of the annual report and treasurer's statement for session 1908-09, an address was given by Mr. C. P. Hogg, president, and a paper on "Electrically-driven reversing rolling mills," by Mr. C. A. Ablett, B.Sc., was read. The "James Watt" anniversary dinner will be held on Friday evening, January 21st, 1910.

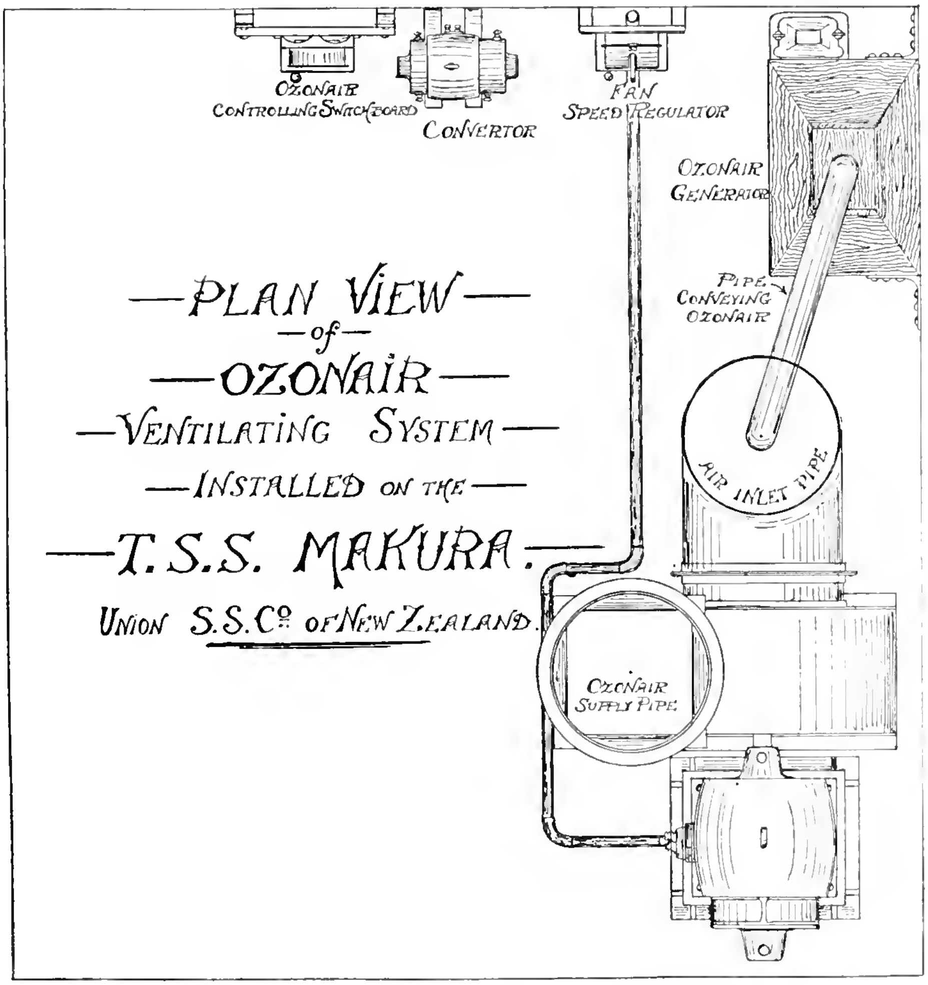
OZONAIR APPARATUS FOR SHIPS.

THE Company which supplies the plant for the production of ozone to be mixed with air, *viz.*, Ozonair, Ltd., of 96, Victoria Street, Westminster, S.W., is stated to be the only establishment which produces by its generator, ozone without any admixture of nitrous oxide compounds.

The general qualities appertaining to ozone, which we may term concentrated oxygen, have now become generally well known, and the improvement in health

It is with these valuable aids to the use of ozone, that Ozonair, Ltd., determined some time back to introduce its system into large boats, so that the passengers will be able during the voyage to inhale ozone in their quarters, which will give a valuable aid to their general health, and also certain latent diseases may be stopped and arrested.

It has been found that, in even the state-rooms, which are sometimes occupied by two or more persons, the night atmosphere becomes exceedingly vitiated, being impregnated with the exhalations from the lungs of those present.



Plan of Ozonair Apparatus installed on the s s. *Makura*.

of persons who are in a position to inhale it, is now generally accepted as being due to the ozone.

Further than this, the effect upon many diseases affecting the lungs and in anæmia, is noticeable, and in cases of malaria, typhoid fever and cholera, the bacilli are immediately destroyed. The whole therapeutic value of ozone lies in its great powers of oxidation, so that lung diseases are definitely stopped and arrested, whilst the breathing of ozone is sufficient in cases of severe anæmia to render the red corpuscles of the blood more numerous. A great number of scientists and doctors have already given the hall-mark of their approval to the value of the use of ozone as a desirable and valuable assistant to health.

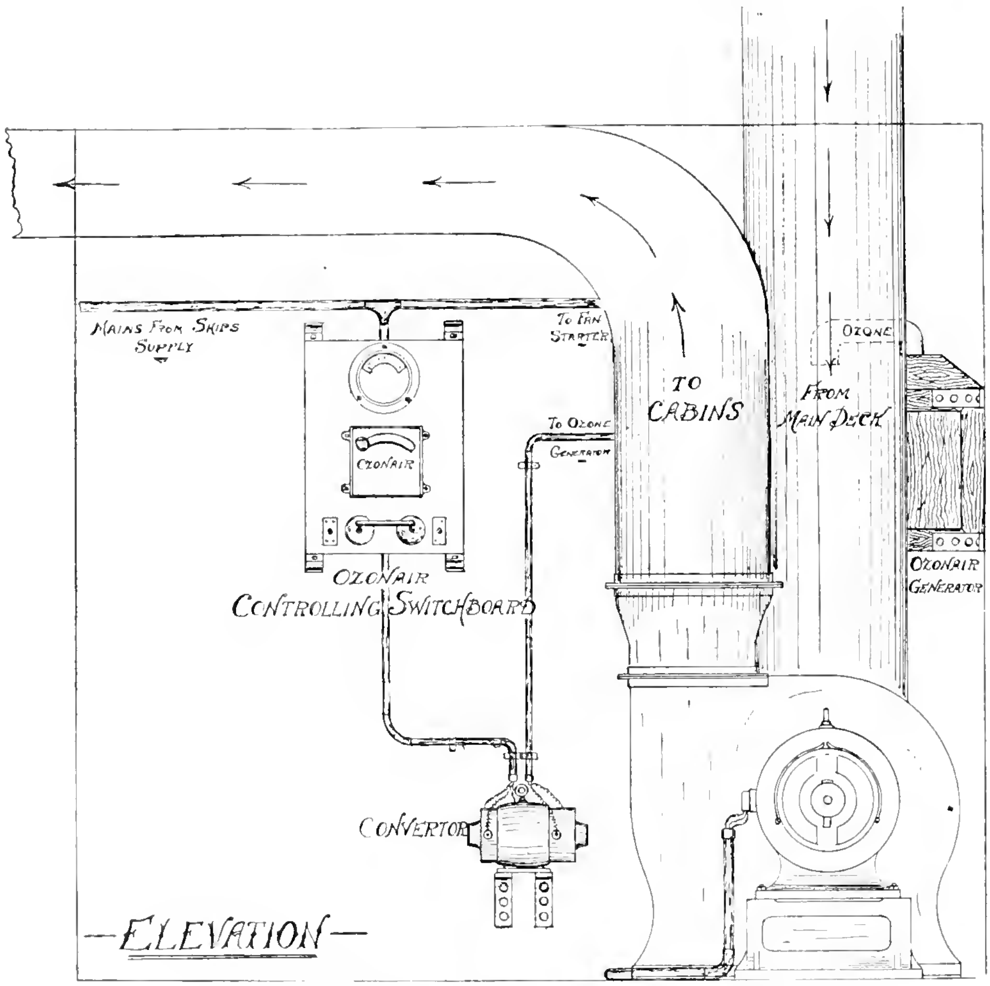
Ozone, it is found, if mixed with air to an extent of 1½ parts in 1,000,000 parts of air by volume, will attack the vitiated air and will impart to the atmosphere health giving properties.

We illustrate in plan and elevation a plant which has been installed on the t.s.s. *Makura*, owned by the Union S.S. Co., of New Zealand, and built by Messrs. Alex. Stephens & Sons, Ltd., during last year, and we have seen letters from the Sydney agents of the Company to the effect that the plant did all that was claimed for it, adding greatly to the comfort of the passengers. They considered that the plant supplied was sufficient for twice the work it was called upon to do, and that

the next of the Company's steamers ordered will be installed throughout with the Ozonair apparatus.

Now as regards the plant. The ozone generator, which is an essential part of this plant, is formed of a series of plates, of which the two outside poles are made, of very finely articulated meshes with a central plate between them. Through this series of plates an alternate current of high periodicity is sent, and by its action a product of ozone is formed which is mixed in the pipes driven by a fan with a very large quantity of air. It must be noted that the ozone is generated without sparking discharge of the current, and therefore produces pure ozone with no admixture of nitrous oxide or other impurities. In addition to this plant we show a separate complete ozone generator and a fan which will draw fresh air, and is suitable to ventilate a cabin or a smoking-room, and a wall-type generator which might conveniently be used to produce Ozonair to thoroughly ventilate the passages leading to the engine-room.

We also illustrate a new type of self-contained apparatus of handsome appearance, the case being made of aluminium. It can be operated by merely attaching it by means of the ordinary flexible cords to the electric lighting circuit. It is extremely portable and specially suitable for use in the saloon, smoke-room or any other place where there is no special means of air purification.



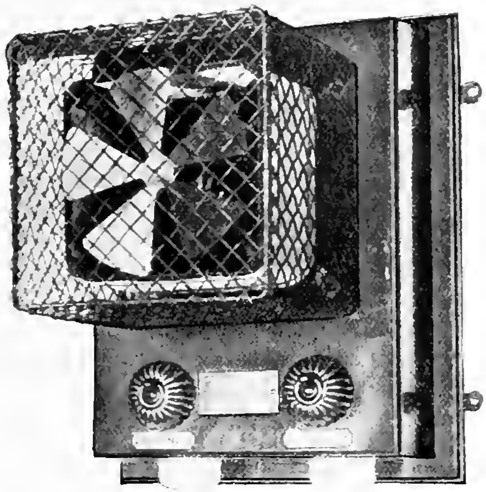
Elevation of Ozonair Apparatus installed on the s s *Makura*

the elevation of the apparatus installed in the *Makura* is shown an inlet pipe which takes up external fresh air from the decks by means of a fan, and into this, a supply of ozone from the generator is injected by an internal pipe, after which the air, properly ozonized, can be distributed to proper inlets into the various state-rooms and other places.

The use of a converter is necessary for these ozone generators to convert the direct action of the ship's current into an alternate current of great periodicity, which is passed through a series of switches by which the fan or the production of ozone can be varied as might prove desirable.

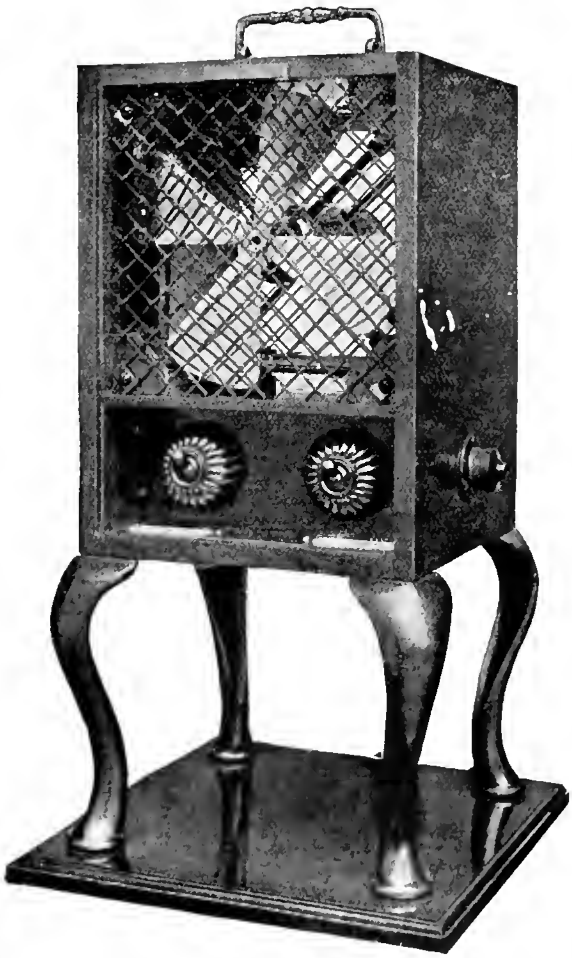
With regard to ships fitted to carry meat and fruit, we illustrate a combined self-contained apparatus producing a concentrated supply of ozone that would serve to render the atmosphere quite neutral and disinfected during transit of perishable articles. When a vessel has arrived with a cargo of meat on board it is very essential that the whole atmosphere of the refrigerating chambers must be disinfected before a new cargo can be put on board, but we consider that if such chambers were purified as regards their atmosphere with Ozonair, further disinfection would no longer be necessary.

The cost of upkeep of the plant is exceedingly



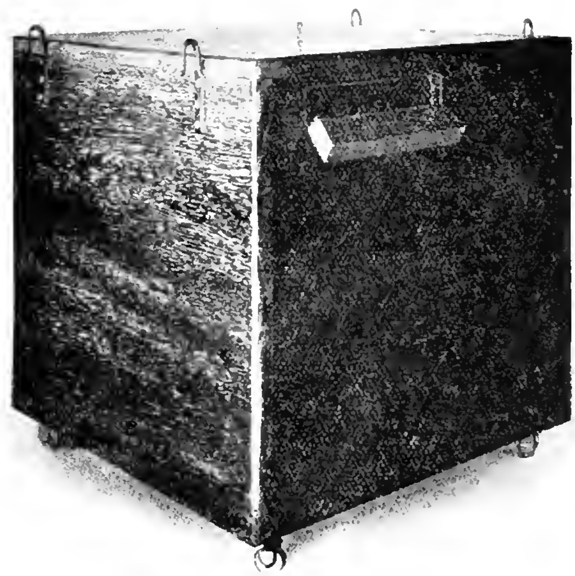
Wall Type Generator and Fan for Passages.

small, and only about one-horse power for the generation of current is necessary to supply sufficient ozone for a whole ship. The entire cost is therefore substantially the prime cost of such plant as may be required, there being no attention or skill required in keeping the Ozonair plant going and the cost of installation is small.



Ozone Generator and Fan, suitable for Cabins, etc.

THE "RAMTIRTH."—The trial trip of a small steam yacht, the *Ramtirth*, which Mr. Edward Hayes, of Watling Works, Stony Stratford, has built for H. H. Chief of Jamkhandi, India, has been run. The length of the *Ramtirth* is 40 ft., width 9 ft., and draught about 3 ft. She has a handsome saloon forward of teak upholstered in red leather, each window opens and has blinds to match the cushions, a large cupboard, folding table and sleeping bunks are also fixed in the saloon. Aft under deck is the storage for wood fuel while the deck space will be used for the native crew. On each side of the main engine are steel deck houses sunk in the deck, the floors being about level with the water line; that on the starboard side is the lavatory, fitted up in the most convenient way, and that on the port side is the galley, in which is fixed a large cooking stove. The machine consists of a standard set of Hayes marine compound non-condensing machinery, cylinders 6 in. and 12 in. by 8 in. stroke, large vertical marine boiler having about 300 tubes working at 120 lbs. working pressure. A canvas awning extends over the boat and is carried on galvanized stanchions. The contract speed for this boat was 9 miles, but she made nearly 10.



Ozonair combined self-contained apparatus, suitable for holds and refrigerating chambers.

THE SCHMIDT'S SUPERHEATING COMPANY, LTD.—In showing the progress of superheating as applied to some vessels on the Continent the Schmidt's Superheating Co., Ltd., have during the past six months received orders for the fitting of their Patent Superheater to the following steamers:—Three cargo vessels, un-named, Messrs. Hugo Stinnes, Mulheim, 1,750 I.H.P. each; *Brema*, cargo vessel, Argo Steamship Co., Bremen, 900 I.H.P.; *Seigen*, cargo vessel, Argo Steamship Co., Bremen, 800 I.H.P.; *Eberfeld*, cargo vessel, Argo Steamship Co., Bremen, 800 I.H.P.; *Lowenberg*, Messrs. Hansa & Co., Bremen, 2,000 I.H.P.; *Phœnix*, Messrs. Leonhard & Blumenberg, Hamburg, 850 I.H.P.; *Erlangen*, cargo vessel, The North German Lloyd, Bremen, 2,250 I.H.P.; *Langer*, cargo vessel, The Oldenburg Portuguese Steamship Co., 600 I.H.P.; *Canaria* Messrs. Rob. Slomann, Hamburg, 1,200 I.H.P.; also three un-named vessels for Messrs. Rob. Slomann, Hamburg, 1,050 I.H.P. each; *La Garenne*, cargo vessel, Compagnie Générale Transatlantique, Paris, 1,050 I.H.P.; *Amiral Zanzguiberry*, Compagnie des Chargeurs Réunis, Paris, 1,200 I.H.P.; twenty-seven river and harbour boats having an aggregate H.P. of 11,000; total, 22,650 I.H.P. The Oldenburg Steamship Company have ten ships and the Argo Steamship Company nine vessels fitted with the Schmidt Superheater.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

The Cunard Company

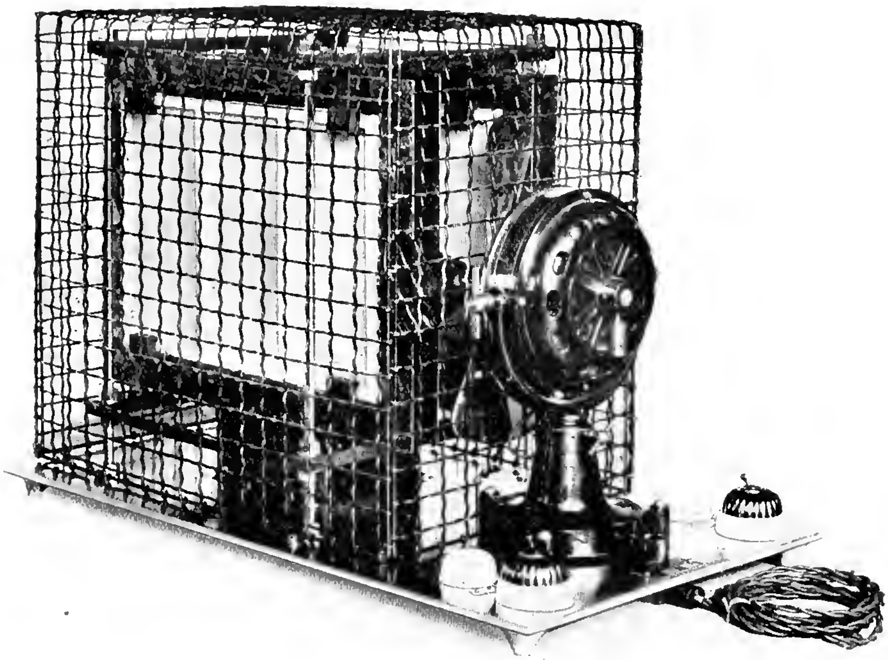
has been deprived during the month of the services of two of those who were prominent in the recent bold advances which have restored it to the position of holding all Atlantic records, Mr. William Watson, the late chairman, by death, and Mr. James Bain, the company's marine superintendent, by retirement. In another column we shortly review the changes. The company seems to be still in the market for new tonnage, and rumours regarding the intention of the directors are somewhat conflicting. But the position seems to be this—there is, of course, a steamer building by Messrs. Swan, Hunter & Wigham Richardson to replace the *Slavonia* in the Mediterranean and New York service. This vessel will be of a speed not exceeding some 17 knots, and for that reason will be fitted with reciprocating engines of the quadruple-expansion type. In addition, it is said that tenders are to be invited for three smaller vessels to be used in the Liverpool and Mediterranean trade instead of the aged *Aleppo*, *Cherbourg* and *Saragossa*. The first of this trio was built at Clydebank as long ago as the year 1865, and even the two younger ships are each thirty-five years old. Then there is talk of the building of another big liner of about 23 knots sea speed in place of the *Lucania*, which, having been sold to Messrs. Ward, of Sheffield, after the recent fire, is to be broken up at Morecambe.

The P. & O. Company

is using its fine fleet of "M" class mail steamers for the benefit of travellers on many of the lines which it maintains. One or other of these vessels is appointed to take every sailing—with one solitary exception—from Sydney to London during the next six months, whilst three of them are to visit a New Zealand port before leaving Sydney, so as to give passengers from that Dominion an opportunity of travelling to Europe by P. & O. steamer without change. China passengers can, of course, always travel by these ships west of Colombo by transhipping at that port, and similarly opportunity is given to Bombay travellers to sail by them on the homeward side of Aden, if they make use of the service maintained by the twin-screw mail steamer *Salsette* on the weeks when there is no direct steamer to Bombay. But additional advantages are now offered, inasmuch as the *Macedonia* is appointed to bring passengers from China direct in March, 1910, and the *Mantua*, homeward-bound from Sydney, is to call at Bombay in February. The intermediate services are being further improved by the diversion of the *Oceana* and the *Arcadia*, the two Harland & Wolff-built Jubilee sisters, to this business. Meanwhile there is a rumour that orders for two more steamships for the fleet are about to be placed.

Danger at Sea.

Under this heading there has been a correspondence in the *Times* as to the risk run by cross-channel steamers from collision with American mail steamers bound up or down from the North Sea to the Atlantic Ocean. A Mr. Francis details his experience about the Newhaven and Dieppe steamship *Tamise*, when crossing from the French port, on the 4th October. When not many miles from Beachy Head she sighted the Nord-Deutscher Lloyd liner *Kaiser Wilhelm II.* inward bound from the Atlantic. The courses of the two ships were nearly at right angles and the rule of the road under the circumstances enjoined that the German vessel should give way to the Frenchman—the latter, under the regulations, being obliged to maintain her course and speed. It would appear that both vessels disobeyed the rules. The German held on his course and obliged the channel steamer to slow down, whilst the latter instead of maintaining her course and speed—according to the evidence of the writer of the letter—repeatedly gave a two-blast signal. The meaning of this two-blast signal is "I am directing my course to port." There is little, therefore, in this particular case on which fault can be found with those in charge of the Atlantic steamer. But there is no doubt that such vessels are apt to be navigated as though they had the monopoly of the ocean, and they do not like giving way and know that the advantage of size, speed and weight are with them if haply a collision should



Ozonair New Type Self-Contained Portable Apparatus, suitable for Saloons, Smoke Rooms, etc.

occur. The obligation to maintain course and speed is, of course, based on the assumption—and a perfectly sound legal assumption it is—that everybody, everywhere, will obey the law. That is all very well when one is dealing with those who will do so. But when one meets with those who are notoriously inclined to shirk their responsibilities the position becomes unpleasant. It is doubly so when one is holding on against an approaching ship many times one's own size and weight and one as to whose practice there have been frequent complaints. I do not envy the navigating officer of the smaller vessel, as the two vessels approach nearer and nearer, and he has to make up his mind as to whether or no he must obey the rule and suffer or break it in the hope of avoiding collision.

The "Plympton."

A somewhat unusual case was that of the *Plympton*, owned by the Commercial Steamship Company, into the circumstances attending whose loss at St. Agnes, Scilly, a Board of Trade inquiry has just been held at Cardiff. The vessel, it appears, went ashore on the Sathegar Rocks during a fog on the 14th August, and became a total loss. The wreck occurred at 8 a.m. and it was recorded in the master's statement that during the night the vessel was reduced to half speed with several stoppages, some on account of the proximity of other vessels and others to enable casts of the lead to be taken. The chief and second mates in their statements confirmed the evidence of the master as to the repeated resort to the use of the lead. Unfortunately the log book was not produced. Though the master saved many important books, the log book was not amongst them, and one witness, the boatswain, swore that he saw the chief mate throw some papers and a book that looked like a log book into the sea. But apart from the production of the log book it was established by the admission of the officers themselves that their statement as to the use of the lead during the night preceding the wreck was untrue—whilst a seaman who had said that he had cast the lead also desired to withdraw his statement. In the event the Court suspended the certificates of the master for six months for negligence in navigating his ship and expressed its strong condemnation of the master and mates in concocting a story as to the use of the lead which they now admitted to be false. With this pious expression of opinion as to the wrongfulness of concocting stories the court seems to have been satisfied that it has done its duty. To my mind this is a very serious matter. A deliberate mis-statement of a material fact has been made by three responsible and certificated officers and has been recorded by the Court. Two of the officers escape with a mere record of the fact. The third is indeed suspended. But his suspension is for negligence, not for mis-statement. Is the matter going to rest where it stands? I hope not. For there is a good deal of criticism as to the conduct of these inquiries at the moment. Most of the allegations are to the effect that officers are not fairly treated. I do not see much to support this charge. Indeed, the case of the *Plympton* is all the other way. Severity or at least substantial notice of a deliberate attempt to mislead the Court was certainly called for, and it appears as yet to have been called for in vain.

The "Slavonia."

Captain A. G. Dunning, who commanded the Cunarder *Slavonia* on her ill-fated voyage, has written a letter in which he pays a well-deserved tribute to the engineering staff of that vessel for the determination and pluck which they evinced on the occasion of the wreck. After the stranding they remained at their posts till driven out by the influx of water. The main engines were, of course, useless and the damage sustained by the hull was such that pumping was of no avail. But in a modern steamer there are other reasons why it is essential to keep machinery going as long as humanly possible. There was every reason to keep the dynamo running in order that the Marconi operator should be able to call for assistance, and it was through the fact that the engine room staff remained below that the prompt assistance of the German steamships was secured. Further than this, they stood by the ship after they were driven from their work and remained on deck throughout the night in a heavy rainstorm in company with the navigating officers. Captain Dunning concludes his appreciation of their conduct with the remark that their services were of the utmost value. In this connection I may perhaps observe that evidence is accumulating to show that at about the time at which the *Slavonia* took the rocks conditions in the neighbourhood of the Azores were quite abnormal as to currents, whilst it would also appear that the atmospheric conditions were somewhat deceptive.

The "Netherton."

It may be remembered that nearly two years ago the steamship *Netherton* was seriously damaged by fire at Singapore. She had on board a cargo of benzine which ignited, and the fury of the flames was such that the vessel was gutted forward, her sides at the fore end actually tumbling inwards. The vessel was a large and valuable one, having been built on the Tyne by the Northumberland Shipbuilding Company as recently as the year 1905, and being of nearly 4300 tons gross register. At first it was considered that the damage she had sustained was irreparable, and I believe she was actually struck off the register as a total loss. But at the beginning of the present year she was purchased for some £3500 by Messrs. W. H. Severidge, of West Hartlepool, and temporary repairs having been ingeniously carried out, she came home to that port under her own steam. She has now been sold again, the purchasers on this occasion being Messrs. Sota & Aznar, of Bilbao. They have renamed her *Jata Mendi*, and are taking her to Bilbao where permanent repairs, which will occupy from five to six months, are to be carried out.

Canada's Ocean Trade.

Reports are still flying about as to the future control of the Allan Line. Early in October the *Montreal Witness* published a definite statement that the fleet had changed hands at a price given as £2,400,000, and of this report, neither a confirmation nor a denial could be obtained. Meanwhile it may be remarked that something definite must be on the *tapis*, for at the time of the rearrangement changes a few weeks ago, it was stated that the chief employés were only confirmed in their positions for a certain twelve months.

Messrs. Harland & Wolff, too, have been the subject of many reports of late. First of all there was a statement as to changes in the controlling interest of the Company. Then there was talk of Canadian developments. The Dominion is about, of course, to provide itself with a navy of its own, and there is a feeling in some quarters that it is most desirable that the new vessels should be built in local yards. So the report got abroad that Messrs. Harland and Wolff were about to establish a branch yard to construct these intended warships. It is open to comment here that though they have built an Admiralty yacht and constructed the machinery of important men-of-war, their real activity has always been in connection with ships of the mercantile marine, and to that extent the rumour seemed a little improbable. But it was soon definitely stated that a shipyard of that kind was not under contemplation at present at all. The recent development by the firm at Southampton will be within the recollection of most of my readers. Messrs. Harland & Wolff being shipbuilders in ordinary to the International Mercantile Marine Company, and many of that Company's lines centring at Southampton, it became desirable for the firm to start a works at which repairs could be thoroughly and rapidly completed. What happened at Southampton is apparently to be repeated in Canada, where the recent provision of the large steamers for the White Star Dominion service has largely increased the importance of the Combine's interest in the Canadian trade. Further, there is a difference between the position in Southampton and in Canada, from the fact that whilst at the Hampshire port the London and South-Western Railway is willing and anxious to provide all dry dock accommodation that may be desired, there is no authority on the St. Lawrence to undertake that duty, and so Messrs. Harland & Wolff will find it necessary to provide a floating dock capable of dealing with the largest vessels. Moreover, as the St. Lawrence is closed in winter when the Atlantic seaboard ports assume an importance unknown to them in summer, it will be necessary for them to provide a similar repairing station to that proposed for the St. Lawrence at another place, and for this latter it is probable that the port of St. John, New Brunswick, will be selected.

SOUND SIGNALS.

THAT an instantaneous and clear sound from whistles and syrens is a matter of great importance to all steam vessels, particularly passenger and war vessels, which travel at a high rate of speed and depend largely upon their sound signals to obtain intelligence of each other's movements in the dark or fog, will be conceded by all. In the event of emergency every second is of importance and may be the means of avoiding disaster, and yet many passengers have no doubt noticed the gurgling and spluttering of a whistle when it is required to signal to another

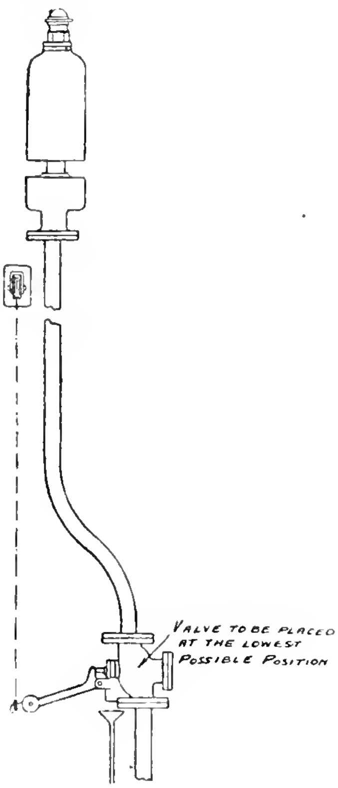


Fig. 1.
Position of Drain.
(The bending of Steam-pipe not necessary)

vessel, and the time wasted before a true and full note is obtained. This is a serious danger in these days of fast travelling, but may be obviated by the adoption of a drain—see accompanying illustrations—which controls the steam and as soon as the signal is sounded automatically drains away the condensed steam, leaving the steam-pipe dry and clear for the next signal.

The sound is immediate and of full note, whilst there is no spray from the whistle on to the deck, whereas ordinarily the condensed steam has to be blown out before the whistle can be sounded.

The drain was formerly known as the "Moller" drain, but the patent rights have been secured by Messrs. The Combination Metallic Packing Company, Ltd., of Gateshead-on-Tyne, who, after many tests and experiments, have improved on it, made it more efficient, and have added to the larger sizes a new patent steam motor which controls the steam and causes it to open and close the valve itself.

The makers claim for this patent automatic drain

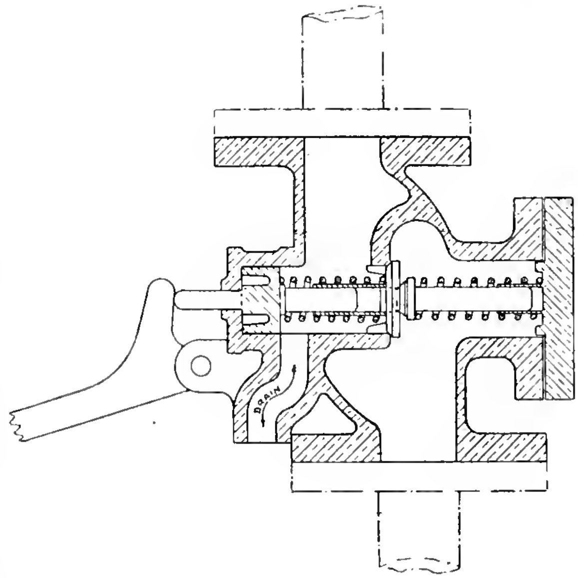


Fig. 2.
CLOSED—Condensed Steam Draining.

the following advantages:—That less than 16 ozs. of power is required to operate the motor or valve, that it is instantaneous and does not depend on electrical power, that it is simple in design and of few parts,

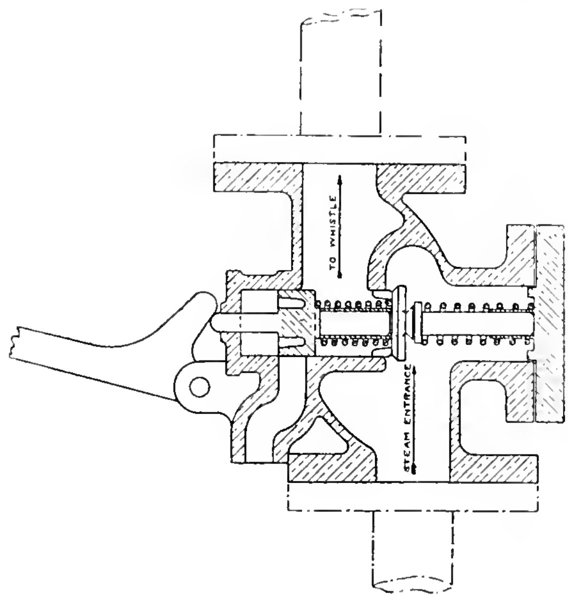


Fig. 3.
OPEN—Sounding of Signal.

and that it is of reasonable cost and requires little or no alteration to other parts.

The "C.M.P." Drain, as it is now called, has been approved of by the British Admiralty, and has been

fitted to many warships, including H.M.S. *Dreadnought*, *Bellerophon* and *Leviathan*, and quite a number of steamship lines have adopted it, among them being the

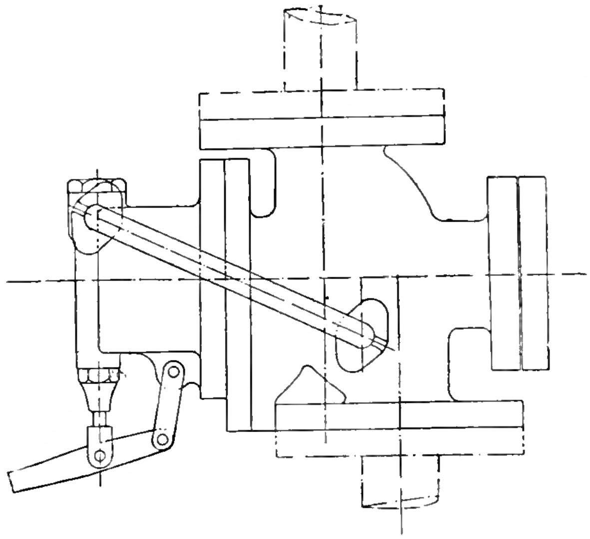


Fig. 4.
Steam Motor Drain.

White Star Line, Cunard S.S. Co., British India S.N. Co., the P. and O. and the Royal Mail S.P. Co.

HULLS OF PASSENGER STEAMERS.—The Board of Trade has recently issued instructions to surveyors respecting the testing of cast-steel and malleable cast-iron material intended to be used in the hulls of passenger steamers.

THE WORSHIPFUL COMPANY OF SHIPWRIGHTS.—Since the dinner to which the Court of the Company was entertained by the Master on the 13th of October, Lord Inverclyde and the Hon. C. A. Parsons have been admitted to the Livery of the Company by the Master, Lord Pirrie, K.P.

QUICK ENGINEERING WORK.—The following achievement of Messrs. David Rollo & Sons, the well-known engineering firm, of Liverpool, deserves to be recorded. It was decided to fit a new high-pressure cylinder of improved design to the engines of the steamer *Star of New Zealand*, and as the vessel is engaged in the meat trade it was important that the change should be effected in the shortest possible time, during, if possible, the discharge of her Liverpool consignment. Messrs. Rollo were approached by Messrs. J. P. Corry & Co., the owners, as to the minimum time required, and the extremely short time of ten days was named. Although this was considered as verging on the impossible, Messrs. Rollo set to work on the vessel's arrival, and, due to their well-arranged appliances for such undertakings, they completed the change, which entailed machining and fitting all auxiliary parts, in the remarkably short period of 5½ working days, thus giving the owners great satisfaction and earning for themselves a goodly sum in the way of premium. The *Star of New Zealand* is a vessel of 4,400 tons, her engines indicating 2,500 horse-power at sea. The firm has been entrusted by the City of Dublin Steam Packet Company with the somewhat extensive repairs to the port engine of their Royal Mail steamer *Leinster*. They have recently completed a very extensive repair to the Warren line steamer *Sagamore*, which included a new stern frame, and have a variety of ship repairing work in hand. All the departments of the works are well employed at the present moment, among other contracts several new boilers for the Brazilian Government. Their foundries, both brass and iron, are very busy, quite a number of heavy propellers are in hand, and a large order of zinc castings are under way for the Brazilian Government.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

Portsmouth Dockyard.

THE launch of the battleship *Neptune* was carried out successfully on September 30th by the Duchess of Albany. At the conclusion of the religious ceremony Her Royal Highness named the ship by breaking the customary bottle of wine against the stem, after which she applied the chisel and mallet to sever the rope. The ship then glided down the slip into the harbour amidst the cheers of the spectators and the strains of the National Anthem and "Rule Britannia." The Duchess afterwards attended a reception at the Admiral-Superintendent's house, when Admiral Tate presented her with a framed water-colour drawing of the ship as she will appear when completed. A luncheon was subsequently given by the Admiral-Superintendent in the dockyard. The mallet and chisel used by the Duchess were presented to Her Royal Highness by Mr. Apsey, the constructor. On the lid of the casket in which they were enclosed was carved a representation of Neptune, with his trident, riding in a chariot, a Triton with a trumpet heralding his approach. On the front was a bronze plate with an inscription setting forth the name of the vessel and the date of the launch. The articles were all richly decorated and were the work of employés in the yard. The *Neptune* has been placed in No. 15 Dock and work is proceeding on her vigorously. No time was lost in preparing for starting the new vessel, and next morning men were at work clearing away the blocks and debris, and the necessary levels were prepared for relaying the blocks on which the *Neptune's* successor is to be built. It is understood that she will be the first of a new type of battleship, and will be larger, more heavily armed, and of a greater speed than her predecessor. A large quantity of material has been received, so that when a start is made there will be no delay. Although the vessel is to be longer than the *Neptune*, it will not be necessary to lengthen the slip, as that was done a couple of years ago. There is a good deal of repair work in hand, including the battleship *Prince George*, on which nearly £70,000 is to be spent. She will not be out of hand until the New Year. The battleship *Hindustan* has had an extensive overhaul and the cruiser *Good Hope* is undergoing the first extensive refit since her completion, which will occupy several months, and will absorb £65,522. Early in November the cruiser *Euryalus* is to be taken in hand for a refit estimated at about £50,000. The cruiser *Sappho*, which since she returned from Dover has been lying at a buoy in the stream, apparently not much the worse for the collision with her namesake, was paid off on September 30th and taken in hand for her defects to be put right at a cost of £18,000. The machinery of the armoured cruiser *Invincible* is being overhauled and she is to be ready to join the First Cruiser Squadron early in November. The cruiser *Hawke* and a few smaller vessels, in addition to several destroyers, are also receiving attention, so that there is not likely to be any shortage of work for some time to come. Then there is the new battleship *St. Vincent* upon which some hundreds of men are at work preparing her for her official trials. All the vessel's 12-inch guns are in position and all the barbette armour plates have been shipped. The battleship *Revenge*, which is employed as tender to the Gunnery Establishment, has lately been under the shears to change her guns. She has had 13·5-inch guns mounted, fitted with 10-inch inner tubes, in place of her former 12-inch guns. The ammunition fired is therefore 10-inch, but the gun drill is the same as for a 13·5-inch gun.

Devonport Dockyard.

The cruiser *Indefatigable* will have been launched by the time these lines appear, the ceremony having been fixed for October 28th. The vessel will be named by Lady Loreburn, wife of the Lord Chancellor, and it is expected that Lord Loreburn will be present. The *Indefatigable* was laid down on February 23rd, and her launching weight will be over 6,000 tons. It is stated that the increase in length of the vessel is 25 feet, in beam 2 feet, and in displacement nearly 2,000 tons, as compared with the 17,250 tons of the *Invin-*

cible class. There has been a slight increase in the size of the turbines, in order that the speed should be 26 knots in this case also. As to the new vessel to be laid down, no more particulars than those already given are available. The battleship *Collingwood* has been moved to a position under the new electrically-worked 160-ton revolving crane on the eastern side of the Prince of Wales' Basin, for the purpose of expediting the work of equipping the barbettes. The work involved the handling of weights of about 50 tons, and this was the first occasion the crane had been used to deal with a series of such heavy weights. It is anticipated that the end of December will see this portion of the *Collingwood's* outfit complete. The *Warrior*, of the Second Cruiser Squadron of the Home Fleet, in which a water-tube boiler mishap occurred recently, arrived on October 4th. The defects will take about eight weeks to make good, and during her refit the entire boiler installation of the vessel, both water tube and cylindrical, will be thoroughly overhauled. It was at first reported that an explosion had taken place in the vessel, but it appears that on September 15th a tube of one of the boilers dropped nearly two inches while the vessel was carrying out firing practice. The effect of the accident was to cause the escape of a large quantity of steam, but no one was injured. As to other work, the vessels in hand include the cruiser *Sutlej*, Rear Admiral Burney's late flagship; the cruiser *Pelorus*, whose refit is estimated at £20,288; the gunboat *Hebe*, on which £19,287 is to be expended; and the destroyers *Contest*, *Starfish*, *Sturgeon* and *Swordfish*. The cruiser *Highflyer*, for which £43,338 is provided, is to be taken in hand almost immediately. The *Hogue*, whose refit has been completed, has been carrying out her after-repair trials; she is to be ready to join the Nore Division of the Home Fleet by November 14th. The destroyer *Lee*, of the local division of the Home Fleet, which was completed to full crew for temporary service with the Atlantic Fleet on September 17th, went ashore at Doolough Point, Blacksod Bay, on October 6th. The crew made every effort to get her off, and they were assisted by the crews of the cruisers *Venus* and *Doris*. The repair ship *Assistance* proceeded to the scene from Queenstown, but nothing could be done. A few days later she broke in two amidships and became a total wreck. The old troopship *Himalaya*, now used as a coal hulk and officially known and designated C. 60, is being fitted with two additional iron masts, which it is anticipated will treble the vessel's capacity for discharging coal. Other improvements are being made to the hulk with the same object. A three days' sale of surplus stores, etc., commeuced on October 12th, but the only lot of public interest disposed of was the destroyer *Hornet*, lying at Chatham Dockyard, which was bought by the Shipbreaking Company, Limited, of London, for £1,200, this including the whole of her equipment. The vessel was built by Yarrow and Company sixteen years ago. The sale was without obligation on the part of the purchaser to break her up, or restriction as to taking her abroad

Chatham Dockyard.

In a short time No. 8 slip, which was built a few years ago at a great cost with a view to building vessels of the largest size, will be vacant. It may, however, be utilised for the construction of steam barges. The last vessels to be built on the slip are the twin-screw tugs *Atlas* and *Pilot*, which are for Portsmouth and Devonport respectively. They will be completed somewhat earlier than anticipated, the date arranged being the beginning of January. The vessels each have a displacement of 615 tons, and their engines will develope 1,400 horse power. The workshops which were erected in the vicinity of the slip and the machines in them are simply deteriorating for want of use. There is, however, no lack of work; indeed, so far as the number of men employed is concerned, the yard is far better off than it was a few years back. The battleship *Venerable* hoisted the pennant on October 19th for service with the Atlantic Fleet. Her commissioning marks another step towards making the battleship division of the Atlantic Fleet homogeneous, there being now five sister ships of the class to which the *Venerable* belongs and only one (the *Albemarle*) of the class of which the fleet was formed last year. The *Venerable's* refit has been a costly affair, and for several months found work for a large number of men. The cruiser *Vindictive* has been taken in hand, but only £10,000 is to be expended on her. The *Minotaur*, of the First Cruiser Squadron, is due early in November for a refit. She is to be commissioned in January for service in the Far East as flagship of the Commander-in-Chief of the China Squadron, in place of the *King Alfred*, which will return home and pay off. The battleship *Lord Nelson*, the flagship of Rear Admiral Briggs, came in on October 6th for her annual refit, and the battleship *Cæsar* and the cruiser *Dido* have come in since for a similar purpose. The battleships *Albion* and *Goliath* have been passed out of dockyard hands on completing their refits, and have resumed duty in the Fourth Division of the Home Fleet at the Nore. Excellent progress is being made with the work of converting the cruiser *St. George* into a depot ship for destroyers, and she will probably be completed by the middle of December. The Navy will soon possess quite a strong contingent of mine-laying vessels. Several vessels have been prepared here for this work, the two latest additions being the *Apollo* and *Andromache*. The *Apollo* is ready for service with the Devonport Division of the Home Fleet, which she will join in November, being retained here for her crew to assist the crew of the *Thetis* in preparing her sister vessel, the *Naiad*, which recently came round from the River Stour, for service as a minelayer. The *Intrepid* has also arrived and a commencement will soon be made with converting her, at an estimated cost of £17,578. She will be the seventh cruiser to be fitted for mine-laying duties. The *Itchen*, which was on a cruise with the Second Destroyer Flotilla, in returning up String Sound to Kirkwall on the night of September 20th, went ashore on Work Head, close into the head on the east side. Next day attempts were made to get her off, but without avail, the cruiser *Sapphire* and the other destroyers assisting. She was towed off on the 22nd and taken to Kirkwall, where she remained for nearly three weeks. The vessel arrived here for repairs on October 18th, under convoy of the scout *Skirmisher*. She was still leaking but the water was easily kept under on the voyage by the pumps.

Sheerness Dockyard.

At the time of writing there are very few vessels in harbour, the ships of the Home Fleet being away carrying out gunnery and torpedo exercises, and most of the destroyers are also absent. The torpedo gunboat *Hazard*, the seagoing depot for Section IV. Submarine Flotilla, arrived from Portsmouth on October 2nd for an extensive refit, which is to include the replacement of her locomotive boilers by water-tube boilers of the type fitted in the *Angler* (30-knot) class of destroyers. Upwards of £19,000 is to be expended on the vessel, which has had over eleven years' active service since she was built under the provisions of the Naval Defence Act. After being at a buoy in the harbour for a few weeks, the torpedo gunboat *Speedy* has again been taken in hand to be finished off. Her refit has taken precedence of that of the torpedo gunboat *Dryad*, the navigational instructional ship at Portsmouth, which has been in hand for some time and has been delayed owing to the men being wanted for other work. The *Dryad's* refit is estimated at £17,000. Additional cabin accommodation for officers undergoing instruction is to be provided, and the vessel is also to be fitted with two water-tube boilers in place of her locomotive boilers. The ocean-going destroyer *Cossack*, of the First Flotilla, has completed her refit, and the *Tartar* and *Ure*, of the same flotilla, have arrived to have their defects made good. The *Erne* has been completed and has been commissioned for the Second Flotilla, her place in the First Flotilla having been taken by the ocean-going destroyer *Afridi*. The steam trawlers *Spider*, *Sparrow*, *Seamew* and *Seaflower*, have returned to Stangate Creek from their fortnight's cruise, during which they carried out successful mine-sweeping experiments at both Portsmouth and Devonport, under the supervision of the staffs of the torpedo school ships *Vernon* and *Defiance*. It is understood that two of the vessels will be stationed at this port and the other two at Portsmouth. Torpedo Boat No. 074, which was extensively damaged at the mouth of the Thames a couple of months ago in collision with a collier, has been passed out of dockyard hands and has rejoined the flotilla in Stangate Creek. The dockyard tug *Robust* left Dundee on October 14th with a party of riggers and lighters Nos. 81 and 83 for the purpose of laying moorings for the *Vulcan*, the depot ship of Section VII. of the Submarine Flotilla, which is to have its base at that port. The section com-

prises nine vessels of the latest "C" type. The *Robust* and the two lighters were caught in the gale on October 15th, No. 81 foundering eight miles off Cromer. The fifteen men on board were all thrown into the sea, but fortunately only one was lost. Another lighter has since been prepared and loaded with anchors and chains for the moorings. Staff-Captain Bawden, who was to have relinquished the charge of the chart and chronometer department on October 1st, is to retain the appointment until January. Lieutenant Hanning-Lee, who is to succeed Captain Bawden, has for nearly three years past been engaged in similar duties at Malta, and cannot yet be spared from that yard. An engine fitter at this yard, Mr. A. E. Beal, has won a National Scholarship at the Imperial College of Science, tenable for three years with an allowance of twenty-five shillings a week during the session, and he has left to enter on his course of study. He had previously won a Whitworth Exhibition of the value of £50.

Pembroke Dockyard.

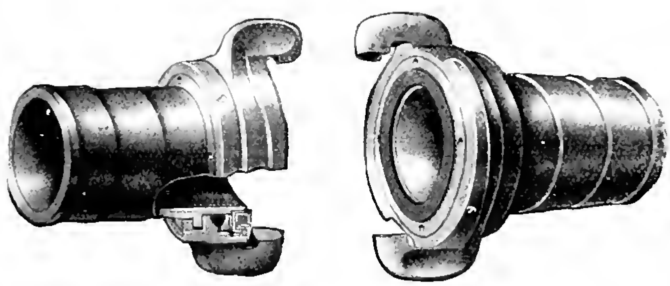
The cruiser *Blanche* is to be launched on October 27th. The preparation of the launching cradle was put in hand six weeks previous to the date of the launch. The ship is practically a replica of the *Bellona*, and the cradle used for the latter vessel is easily adaptable for the new ship. Work on the *Blanche* is making steady progress, but it will probably not be found practicable to bore out for the propeller shafting completely. The propelling machinery of the *Bellona* was subjected to a successful preliminary trial on October 15th. The ahead, astern and cruising turbines were each worked in turn and gave complete satisfaction, causing very little vibration. The auxiliary machinery was also tried with satisfactory results. The ship was dry docked on the 18th to be prepared for the official steam trials, which are to be carried out between November 3rd and 16th. The refit of the destroyer *Osprey* is being pushed on with a view to its completion early in December, by which time the vessel will have been in hand about five months. This is the first thorough refit the vessel has had since she was built by the Fairfield Company ten years ago. Her boilers are being retubed and her propelling engines and auxiliary machinery are undergoing a complete overhaul. The old torpedo gunboat Antelope, which has been lying at the Motherbank, has been brought round for a refit, the probable cost of which cannot, of course, be estimated until a survey has been made. She is a vessel of 810 tons and was built in 1893. Her last service was in connection with the Royal Naval Reserve at Portishead, but she was placed on the non-effective list two or three years ago. She is now to be fitted for fishery protection duties. Sir George Armstrong, the prospective Unionist candidate for the Pembroke and Haverfordwest Boroughs, in a recent speech spoke strongly on the strategical importance of Milford Haven and the necessity of developing this yard for the purpose of carrying out extensive repairs to warships in war time. Sir George said he spoke as a sailor who had served several years in the Navy, and he knew from experience the requirements both of the yard and the Navy. He could not imagine any one proposing another western port as a rival to Milford Haven as a naval base, for its geographical position and commodious harbour made it an ideal place. Such a development could be carried out at no very great cost. It was an urgent necessity, and the Government should be brought to realize it, whatever the cost. It is interesting to note that at the present time there are nearly 1,000 fewer men employed here than there were four years ago. An interesting ceremony took place on October 7th, when the captain-superintendent, Captain Mundy, presented the prizes to the successful apprentices and others attending the dockyard schools.

THE FORTH SHIPPING COMPANY (Messrs. Andrew Weir and Co., London, Glasgow and Middlesbrough), have decided to extend their service between the Forth and Tees to include Boston, Lincs., and thus bring their present districts into touch with the Midland counties. The first sailing from Boston is fixed for October 30th. The sailing days will be—from Grangemouth, Monday; Leith, Tuesday; Middlesbrough, Wednesday, and Boston, Saturday.

STOVE'S PATENT HOSE COUPLING.

It is now some years since Mr. Stove made the improvement in the original Nunan hose coupling, with the result that the device has been extensively used in the British, Japanese, Russian, Chilian, and Portuguese navies, the Indian Marine, P. & O. Steam Navigation Company, British India, Cunard, White Star, and other shipping companies. It will be remembered that the improved coupling has two sleeves, one revolving over the other, which allows all twist to automatically come out of the hose when the water is turned on.

It has been found however that should the inner sleeve become damaged or deformed the outer sleeve would not freely turn upon it and leakage is caused. It may be further pointed out that this form of coupling was not suitable for suction, owing to the loose sleeve drawing air, necessitating a separate coupling having only one sleeve being used for this particular purpose.



Stove's Patent Hose Coupling.

A new form of coupling has now been devised by Mr. Stove, which we illustrate in the adjoining diagram, and which, besides having the advantage of both ends being alike, no male or female joints, no screw threads to damage, and revolving sleeve which allows all twists to be removed from the box, and which were obtained in the previous pattern, has the further advantage of being capable of use with suction or pressure, and can be taken to pieces and any damaged part quickly replaced without the objectionable and lengthy operation of removing the hose from the coupling.

The illustration, which represents two couplings uncoupled, one being shown partly in section, clearly shows that the inner part is provided with an outwardly extending flange, while the outer ring has a shoulder on its inside against which the first flange bears. The front side of the shoulder of the outer ring is bevelled off, and forms, with a corresponding bevelled loose ring, a space for packing. This loose ring is held in place by means of a second ring adapted to hold a jointing washer, and to be held in place by means of a flanged ring screwed into the outer ring, the washer forming the jointing medium for the couplings when engaged.

The outer ring is secured on the inner part by means of a flange screwed into the left-hand end of the outer ring.

These couplings are manufactured by Nunan's Hose Couplings, Ltd., of 10, Norfolk Street, Strand, London, W.C.

THE CUNARD COMPANY.

THE death of Mr. William Watson, at his home, on the 4th of October, as the result of a paralytic seizure, has been met with general and sincere regret by the shipping community. He was a sound business man, and held an influential position in the maritime world. He had been a director for seventeen years, and deputy-chairman for seven years, of the Cunard Company. When the negotiations with the British Government, which ended in the laying down of the *Lusitania* and *Mauretania*, were being conducted, the late Lord Inverclyde, the then chairman, found in Mr. Watson a colleague of tried experience and ability, and upon the death of Lord Inverclyde, in 1905, Mr. Watson became chairman, and carried to completion the building of the two Leviathans. His last public act as chairman of the Cunard Company was to personally attend at Fishguard on the inauguration of the calling at that port of the Cunard Liners. Born in California of English parentage in 1844, Mr. Watson was sixty-six years old at the time of his death.

Photo by Elliott & Fry

Mr. A. A. Booth, Chairman of The Cunard Steamship Co., Ltd.

Following upon the death of Mr. Watson, the directors of the Cunard Steamship Company, Ltd., announce that Mr. A. A. Booth has been unanimously elected chairman of the Board, and that Mr. Thomas Royden has been appointed deputy-chairman.

Mr. A. A. Booth is a member of the firm of Alfred Booth & Company, of Liverpool, London and New York, and a director of the Booth Steamship Company, Ltd., and is on the Board of the Manaos

Harbour Company. He was educated at Harrow and King's College, Cambridge, where he graduated as a wrangler in the Mathematical Tripos in 1894. After leaving Cambridge he entered the firm of Booth & Co., as before stated, and gained valuable experience in steamship management. He joined the Cunard Board of Directors on the 13th December, 1901, and became deputy-chairman in April of this year. He is thirty-seven years of age, and is the second son of Mr. Alfred Booth, J.P., and a nephew of the Right Hon. Charles Booth.

Mr. Thomas Royden, the newly-appointed deputy-chairman, is the eldest son of Sir Thomas B. Royden, Bart., and a member of the firm of T. B. Royden—Indra Line, Ltd.—shipowners, Liverpool. He has had much experience in shipping matters, and became a director of the Cunard Company in 1905. He was educated at Winchester and Oxford, and is under forty.

RETIREMENT OF MR. JAMES BAIN, GENERAL SUPERINTENDENT, CUNARD STEAMSHIP CO.

MR. James Bain, general superintendent to the Cunard Steamship Co., retired from the Cunard service on the 30th September this year. Mr. Bain served his apprenticeship as engineer with the old-established firm

Photo by Kent & Lacey, Ltd.

Mr James Bain.

of Messrs. Robert Napier, Glasgow, and at its expiration he joined the service of the Cunard S.S. Co. This was in 1863, when he was appointed sixth engineer of the *Arabia*. He subsequently served in the following Cunard ships:—fourth engineer in the *Arabia*, August, 1864; *Africa*, October, 1864; third engineer in the *Europa*, February, 1866; *Hecla*, November, 1866; *Aleppo*, August, 1867; and second engineer in the *Atlas*, February, 1869.

He resigned his position with the Cunard Co. in January, 1872, and in the following month joined the White Star Co. as second engineer on the *Adriatic*, and was promoted to be chief engineer of the *Adriatic* in October of the same year.

Three years later he received an appointment as Lloyd's surveyor, which he held for ten years. In 1885 he again entered the Cunard service, this time in the important position of superintendent engineer, and continued to occupy that post until February, 1902, when he succeeded the late Captain Watson as general superintendent, which responsible position he held up to the time of his retirement.

The long period over which Mr. Bain's active services extended has witnessed many interesting changes and developments in marine engineering, in all of which he has played a very important part.

The *Arabia*, the first Cunard ship in which Mr. Bain served, was a wooden paddle steamer of 2400 tons and 3250 indicated horse power. She made 9 to 14 revolutions per minute according to her draught, and her boiler pressure was 12 to 13 lbs. per square inch. Mr. Bain steadily worked his way through ships propelled by paddle wheels, oscillating geared engines, as in the *China*, *Cuba*, etc., the inverted cylinder engines, as in the *Russia*, *Java*. He had, too, a great experience of compound engines, as illustrated by the Cunarders *Gallia*, *Bothnia*, *Scythia*, and later, those former record breakers *Umbria* and *Etruria*, propelled by the finest compound engines ever constructed.

From this stage of the development of marine engineering Mr. Bain passed to the *Campania* and *Lucania*, equipped with triple-expansion engines and later to the quadruple-expansion engines of the Cunarders *Saxonia*, *Ivernia*, *Carpathia* and *Caronia*. The latter vessel, it is interesting to note, is 21,000 indicated horse power. The next vessel of the Cunard S.S. Co. was the *Carmania*, sister ship to the *Caronia*, save that she is driven by turbine instead of reciprocating engines. The unique experience of Mr. Bain was recognised by his appointment as a member of the Admiralty Boiler Commission. Mr. Bain, it will be remembered, was the chairman of the Committee appointed by the Cunard S.S. Co. to investigate the relative efficiency of reciprocating engines *versus* turbines.

MESSRS. LEONARD CHAPMAN & Co., importers and manufacturers, Munton Road, London, S.E., report:—Graphite as imported, according to quality:—

Ceylon L.L. c.i.f. London	£24	10	0	to £40	10	0	per ton
,, O.L. ,,	16	10	0	to 45	10	0	,,
,, chips ,,	14	10	0	to 34	0	0	,,
,, dust ,,	7	10	0	to 26	10	0	,,
Purified, milled and ground							
Ceylon, 97% to 99% f.o.b. London	59	0	0	to 63	0	0	per ton
,, 90% to 91% ,,	40	0	0	to 42	0	0	,,
,, 80% to 81% ,,	30	0	0	to 32	0	0	,,
,, 70% to 71% ,,	27	0	0	to 28	0	0	,,
American large flake, f.o.b. London	45	0	0	to 49	0	0	,,
,, small ,,	35	0	0	to 45	0	0	,,
Graphite Jointed Comp.	2	9	0	to 2	12	6	per cwt.
Graphite Paint Paste ,,	2	0	0	to 2	2	0	,,
Graphite Paint ,,	0	4	6	to 0	5	0	per gal.

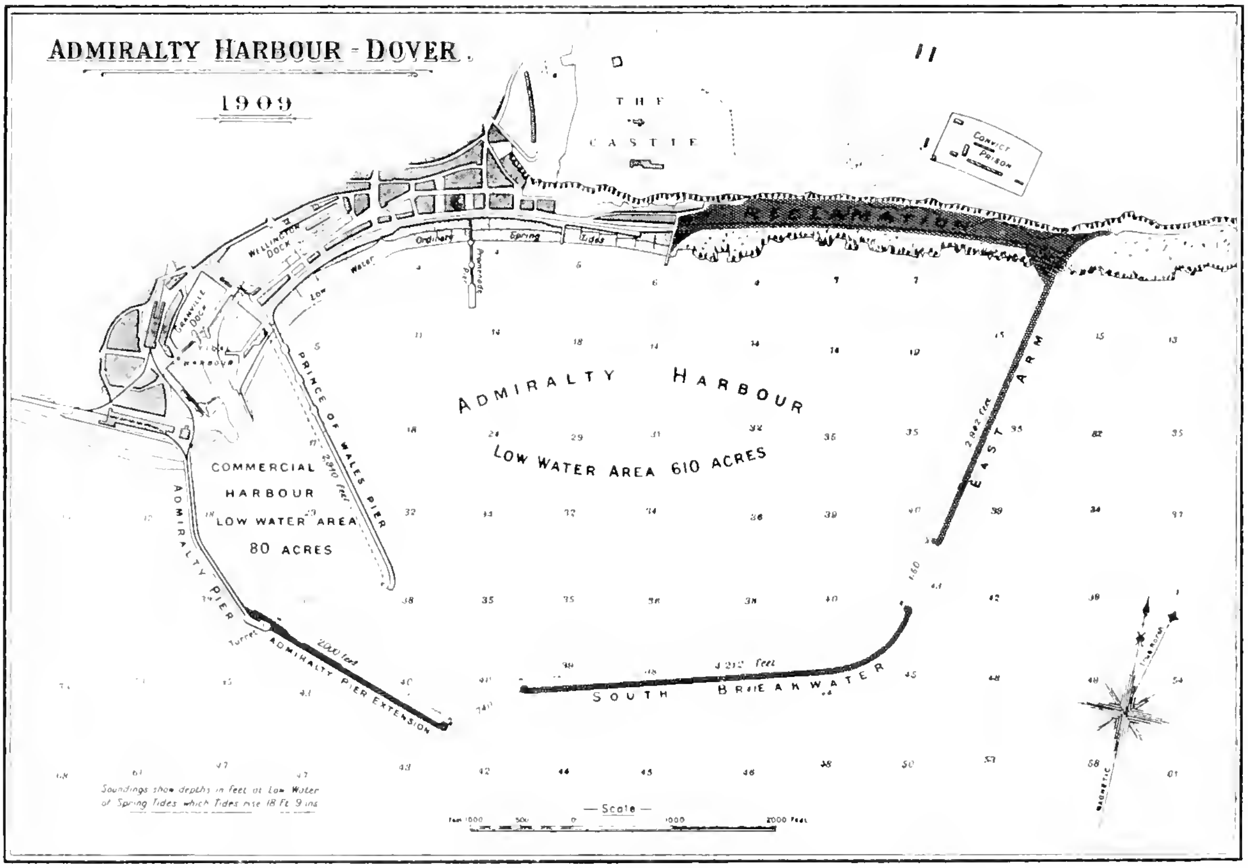
Wholesale lists of tinned goods on application.

THE IRON AND STEEL INSTITUTE.—At the London meeting of the Iron and Steel Institute, which commenced on Sept. 27th, and continued until October 1st, the following papers were contributed:—1, "On the determination of the power consumption of reversing rolling-mills," by C. A. Ablett (London); 2, "On comparative tests of cast iron," by E. Adamson (Sheffield); 3, "On artificial magnetic oxide of iron," by F. J. R. Carulla (Derby); 4, "On action of air and steam on pure iron," by J. Newton Friend, Ph.D. (Darlington); 5, "On corrosion of iron," by J. Newton Friend, Ph.D. (Darlington); 6, "On uniform moisture in blast" by Greville Jones (Middlesbrough); 7, "On the refining of steel by electricity," by Disponent E. J. Ljungberg (Falun, Sweden); 8, "On the fuel economy of dry blast, as indicated by calculations from empirical data," by R. S. Moore (London); 9, "On the 'growth' of cast irons after repeated heatings," by Professor H. F. Rugan (Tulane University, New Orleans, U.S.A.), and Dr. H. C. H. Carpenter, M.A. (Manchester); 10, "On the maintenance and renewal of permanent way," by R. Price-Williams (London); 11, "On the constitution of carbon-tungsten steels," by T. Swinden, B.Met. (Sheffield).

NATIONAL HARBOUR AT DOVER.

The 15th of October saw the formal opening, by the Prince of Wales, of the new National Harbour at Dover, an undertaking which has cost three and a half millions of money, and taken twelve years to construct. It was in 1894 that the Admiralty determined that the defences of the Downs were not adequate, and towards the close of the following year Messrs. Coode, Son & Matthews received instructions for the preparation of an engineering survey of Dover Bay with a view to the framing of plans and estimates for a National Harbour. As a result a scheme was submitted to and adopted by the Admiralty, and a contract placed with Messrs. S. Pearson and Sons, Ltd., in November, 1897, for carrying out the work.

An inspection of the illustration accompanying this article will show the enormous magnitude of the harbour works. The Admiralty Pier has been extended 2,000 feet (its original length was some 2,000 feet), at the eastern end of the town land has been reclaimed for a length of 3,900 feet extending along the foot of the cliffs, a protective arm of 2,942 feet, running from the east end of the Reclamation, has been erected, and a southern detached breakwater, in length 4,212 feet, completes the encirclement of the harbour. The widths of the eastern and western entrances are 650 feet and 740 feet respectively. The low water area enclosed is 610 acres, and there is adequate depth everywhere.



In the process of creating the harbour, at times as many as 1,800 men have been employed, 1,900,000 cubic feet of granite, 1,300,000 cubic yards of concrete and 260,000 tons of cement have been used, and nearly two and a half miles of sea works erected, which have been formed of concrete blocks built as solid structures from the foundations upwards, the blocks being bonded and toggled together. From a point just above low-water mark the concrete is faced with granite, incorporated into the concrete matrix of the concrete blocks. At the base of the structures, seawards, runs in each case an "apron" twenty-five feet in width to protect the foundations. The solidity of the work may be estimated from the fact that the thickness of the sea walls at the base and top is as follows:—Admiralty Pier, base 57 feet; top, over all, 45 feet. Southern Breakwater, base 52 feet; top, 40 feet. Eastern Arm, base 54 feet; top, 47 feet. Along the top of the Admiralty Pier and the Eastern Arm double lines of rails are laid to facilitate railway transportation. The summits of all the breakwaters are at the same height above high water, *viz.*, 10 feet, and the Admiralty Pier extension, also the East Arm, are provided with sheltering parapets, as they will be used for berthage. The Southern Breakwater has not so been provided, but provision has been made for such protection if desired in the future.

The new harbour is, of course, primarily intended for the Royal Navy, and is therefore strongly fortified with 6 in. and 4·7 in. guns and supporting searchlights. Shops and stores for submarine and torpedo craft are provided on the Reclamation, and if necessary a

powerful fleet could be accommodated in the harbour, and no doubt it will be used as a war base for the Naval force defending the Straits. From the point of view of the Dover townspeople they would much prefer to see more provision made for the Mercantile Marine, believing, as they do, that Dover makes an excellent port of call for Ocean Liners, for it appears that more facilities could be given to shipping without in any way inconveniencing the Admiralty or ships of the Royal Navy.

A contract has been placed with Messrs. Pearson and Son by the Harbour Board for widening the Admiralty Pier, and reclaiming some 11½ acres, and a railway station is to be built, which will greatly facilitate Cross-Channel traffic.

The Association of Engineers-in-Charge.—The presidential address by Mr. Henry Adams, M.I.C.E., etc., on Standardization was delivered on October 14th. In the programme for 1909-1910 session the following papers have been arranged for :—December 8th, paper by Konrad Andersson and E. Meden, on "Recent developments in impulse steam turbines." January 12th, paper by T. W. Aldwinckle, F.R.I.B.A., on "Heating and ventilating of public buildings." February 9th, paper by A. Angold, on "Modern arc lamps and their application." March 9th, paper by Jacques Abady, M.I.Mech.E. (barrister-at-law), on "The application of recording instruments to steam generation." April 13th, paper by Reginald J. Wallis-Jones, M.Inst.C.E., M.I.E.E., on "Welding and its application."

INSTITUTE OF MARINE ENGINEERS.

Opening of the Winter Session.

THE opening meeting of the winter session was held at the Institute of Marine Engineers, Stratford, E., on Monday, 27th Sept., the chair being occupied by Mr. A. Boyle (vice-president).

In drawing attention to the syllabus, the Chairman said the Institute might congratulate itself on maintaining its reputation for producing sound, practical, up-to-date papers on engineering subjects. He referred to the loss recently sustained by the death of the president, Mr. James Dixon, and spoke in feeling terms of that gentleman's warm interest in the work of the Institute, and his generosity in promoting its efficiency as an educational force.

Mr. James Adamson, the hon. secretary, also alluded to the unhappy event which had deprived them of their president during his year of office. The council had decided to ask the immediate past president, Mr. James Denny, to resume the chair till the end of the session. This wish had been acceded to by Mr. Denny, who would thus preside at the annual dinner on November 3rd at the King's Hall, Holborn Restaurant.

The Chairman then presented prizes to the winners of the Stephen and Ritchie awards as follows :—

Associate Member : Stephen award for paper on "The Steam Turbine," awarded to "Uranus" (Mr. James S. Gander). Associate : Stephen award for paper on "Feed Heating," awarded to "Engine" (Mr. W. W. Adamson). Associate, Ritchie award for paper on "The Functions of the Air and Circulating Pumps," awarded to "Vacuum" (Mr. Walter Smith), Graduate.

With regard to the award of the Denny Medal the following telegram was read :—

"The artificer engineers and engine-room artificers, Royal Navy Depot, Chatham, appreciate granting of Denny gold medal to Mr. Durtnall for his paper on 'Electrical Propulsion of Ships.' His lectures have been greatly appreciated at Chatham. E.R.A."

Papers on "Hydraulic Cargo Gear for Passenger Ships," by Mr. A. M. M'Alister, and "Water Hammer," by Mr. Bishop N. King, were afterwards read, and discussion was postponed.

THE TURBINE.*

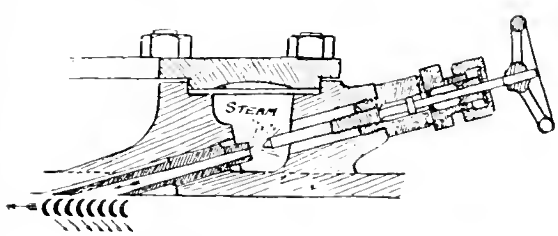
Evolution, Modern Type, Construction, Working, Comparisons, etc.

FROM the time when the steam engine emerged from the experimental stage, and took its place in the industrial world as an economical means of power, engineers have tried to perfect some form of rotary engine capable of transforming the energy of steam into H.P. with a higher percentage of efficiency than the reciprocating engine gives. When we consider that only about 15 per cent. of the total heat of the steam is converted into available energy or useful work, it is obvious that the reciprocating engine is an imperfect and uneconomical one.

The De Laval turbine cannot be said to have accomplished much in the direction of economy, for upon economy much depends, and more so with reference to marine engines. Less economy means more coal, more coal means larger bunkers, larger bunkers means a reduced cargo-carrying capacity, and so on *ad infinitum*.

This turbine is used extensively in the colonies, where distance from towns prevents the use of electricity, in connection with dairy work and work requiring small means of power, unskilled attention, and where economy of fuel does not have to be considered. It is used with success for dynamos in marine work. Apart from the question of economy, the great objection against its adoption for driving the shafting of marine jobs is its high speed. This may, of course, be reduced by suitable gearing, but to reduce from 20,000 revolutions per minute to, say, 500 means loss of efficiency in friction, and is altogether undesirable. The efficiency of this turbine is greatest when the circumferential velocity of the blades equals half the velocity of the steam ; and as the steam velocity is very great, we obtain the greatest efficiency at about 20,000 revolutions per minute.

As shown in accompanying sketch, steam is admitted to



Arrangement of Nozzle and Shutting-off Valve, De Laval Turbine.

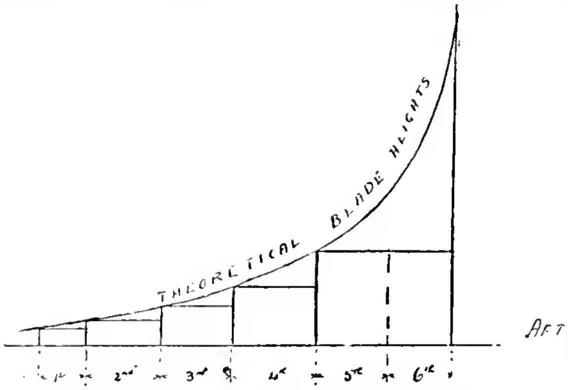
nozzles (from four to six in number, as the case may be), and, as the nozzles are enlarged at the orifice, expands, and the resultant kinetic energy acts directly on the vanes or buckets. Therefore, we see that in this type of turbine the wheel is rotated by steam at the *expanded* or *lowest* pressure as the expansion takes place in the nozzle. The steam admission to the nozzles is regulated by hand valves. A model turbine of the De Laval's type may be seen in the South Kensington Museum in section with the wheel exposed and the nozzles in section also.

Parsons Turbine.—This turbine is the latest and most improved development up to the present. Steam is admitted direct from the boilers on to the blades fixed to the shaft, and thus does away with the necessity for the multiplicity of moving parts of the reciprocating engine.

It was predicted by engineering experts that this turbine, applied to ship propulsion, would be a rank failure, because the blades would strip through wearing down of brasses, causing the blades to come in contact with the casing, loosening of blades through bad workmanship or centrifugal stresses or strains, presence of dirt from boilers and various other likely causes. All this may be true, but up to the present experience has not justified the prediction. The modern

* Prize Essay by "Uranus" (Mr. James S. Gander), Associate Member, Institute of Marine Engineers, and written for the Stephen Award—Associate Member Section.

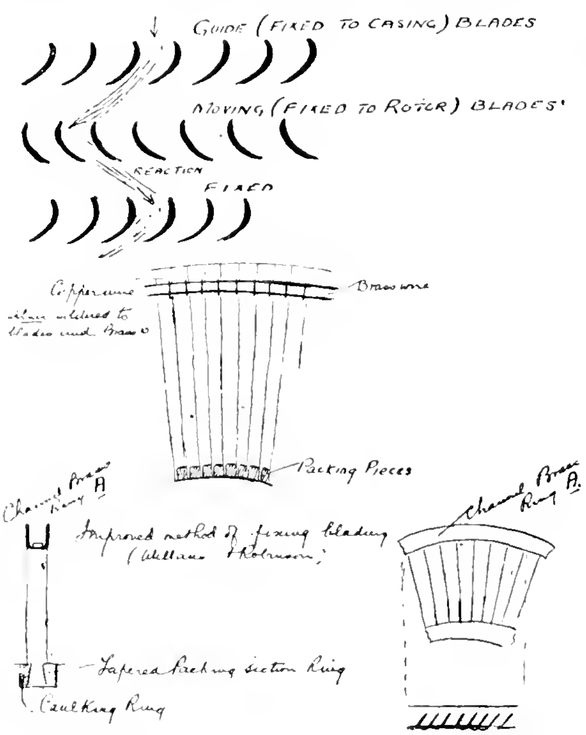
turbine represents the apotheosis of scientific engineering *design* and *accurate* workmanship. The student or chemist understanding the adiabatic expansion of steam can at once see the reason for the increased circumferences of the blades from forward to aft. The mechanical engineer sees the



Showing method of adapting Blading to approximate Adiabatic Curve. L.P. Rotor.

difficulty in construction of the rotor in conformity with the outline of the adiabatic curve, and obtains, as near as matters, the same result by "stepping" the blades.

Briefly, the Parsons turbine consists of a cylindrical casing fitted with rings of *inwardly* projecting blades. Inside the cylinder (which is of variable diameter, corresponding to the stepping of the blades) is the *rotor* (a shaft or spindle on which



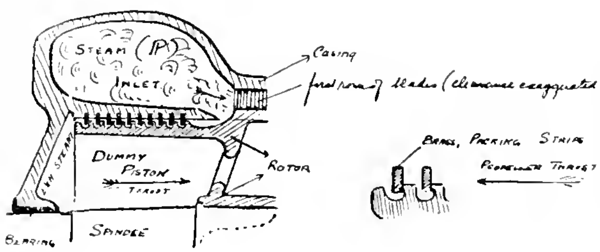
Improved method of Fixing Blading (Willans & Robinson)

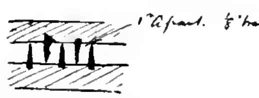
are mounted blades projecting *outwardly*). The blades on the "rotor" are of such diameter that they "clear" the casing, in the spaces between the fixed blades of the casing, by about $\frac{1}{50}$th of an inch H.P. end, varying to $\frac{1}{25}$th L.P. end. This difference of clearance is necessary because of the greater diameter, and therefore greater expansion of the L.P. end, under the action of steam.

As the rotor revolves, the blades fixed to it (moving blades) travel round, while the casing blades (fixed blades) are necessarily stationary and act as *guides* to deflect the steam on the following set of moving blades, and so on, until the steam has travelled from inward to aft of the machine, each succeeding ring of fixed blades deflecting the steam on to the next ring of moving blades. The angle and curve of the moving blades in conjunction with that of the fixed transmits the energy of the steam to the rotor, and the shaft revolves. It is considered that the steam passing through the turbine from end to end follows a spiral or screw-like course.

The steam in the turbine expands adiabatically (practically) no heat being given out or taken in during expansion. Here it has an advantage over the steam engine, where the incoming steam is partly reduced in temperature by the walls of the cylinder, which have just been cooled (as it were) by the drop in temperature of the steam at the end of the stroke. Another advantage is that, whereas in the steam engine (triple expansion) the number of expansions would be about $22\frac{1}{2}$, we can easily obtain in the turbine as many as 125 to 140.

Admitting that the object of *triple-expansion* engines is to reduce the *range* of temperature in the cylinders to minimize condensation (and consequent loss of heat), we arrive at another good point in the economy of the turbine, *i.e.*, although the temperature of the casing and rotor drops as we approach exhaust, yet the temperature in any particular expansion remains constant. The angle at which the blades are set is a very important factor, and generally each ring of blades contains two or more "stoppers" (casing only), in order to set the correct angle. These are left in permanently.





Dummy Piston.

Enlarged Section showing how steam is wiredrawn.

Reverse Dummy Piston showing different arrangement of Dummy Packing.

A very important consideration is the perfect balancing of the "rotor" in order that vibration and stresses at high speeds may be eliminated. This is done by balancing the ends of the shaft along knife edges, and cutting away or pinning on metal as required. "Dynamic" balancing is also attempted, but at present no instrument has been devised to accurately plot stresses at high speeds.

The dummy piston at each end of the turbine (reversing type), by reason of the pressure of steam behind it, counteracts the thrusting effect of the propeller, and the "thrust blocks" used are insignificant in comparison with those of the ordinary marine engine, and only come into action occasionally.

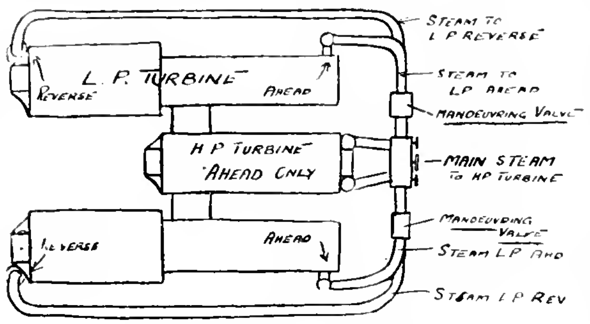
The manner in which steam is prevented from blowing out at the ends of the casing, at the dummy pistons and at steam glands, is very ingenious and remarkably effective. Instead of clumsy packing glands producing a large amount of friction considering the diameters and speeds, we have the neat and effective arrangement of rings shown in sketch. Indeed, packing glands would be an impossibility, and it may be said that but for this arrangement the turbine would be a hopeless failure.

Lubrication for the thrust and main bearings is effected by injecting oil at a low pressure, 8 lb. per square inch or thereabout, between the shaft and bearings, and circulating the

same by means of pumps and cooling tanks, etc. A water jacket also surrounds the lubricating chamber, and constant circulation induced.

By experience it has been found that to overcome difficulties of manœuvring and reversing the most suitable form of turbine arrangement is to have the H.P. ahead turbine in the centre and L.P. starboard and port reversing engines, so that, in the event of full speed astern, the H.P. turbine is stopped (dragged round slowly by the propeller in a vacuum), and starboard and port engines reversed, the ahead blades of these revolving in a vacuum while steam is admitted to the opposite end, and at the same time shut off from the other. This arrangement is very simple, and, what is more important, carried out quickly, which goes somewhat to balance the fact that generally the "reverse," or *go astern power, is only about equal to one-third of the ahead power*. Generally the reverse blades of the L.P. rotors are about the same dimensions as those of the H.P.

Reversing suddenly puts a great strain on the blades of the rotors in turbines; to partially overcome this, byepass



Steam and Reverse Valve Arrangement.

valves are fitted to allow steam to pass to lower expansions for starting or developing extra astern power. The same applies also to the ahead blades for starting.

The various *clearances* are matters of vital import, and dial plate gauges and studs are fixed in order that the slightest wear in any direction may be detected, and also that difference caused by heating up as compared with the clearances when cold. When we consider the minute clearances necessary, and the expanding effect of heat on casing and rotor, it is obvious that great caution must be exercised by the engineer on watch to avoid catastrophe.

The condensers and air pumps are arranged to produce high vacua, as, to quote the Hon. C. A. Parsons, "An addition of 1 in. to the vacuum in the condenser over 26 in. deducted 4 per cent. from the steam used, a further increase of the same amount, 1 in., meant a further gain of $4\frac{1}{2}$ per cent., while 29 in. brought the steam consumption down $5\frac{1}{2}$ per cent. more." This evidently gives a saving of 13 per cent. with 3 in. more vacuum.

To increase the vacuum as far as possible two air pumps are sometimes used, "a wet" air pump and a "dry" air pump, the former dealing with water and vapour, and the latter with vapour only. An "augmenter" has also been introduced to work in conjunction with the "wet" air pump, to still further increase the vacuum. In this a jet of steam exhausts the air from the condenser and delivers it to the pump. Return of this to the condenser is prevented by making a U-bend in the pipe leading from condenser to air pump, thus forming a "water seal."

The propellers used with turbines differ from the ordinary type. We are confronted with this:

High speed gives efficiency of turbine

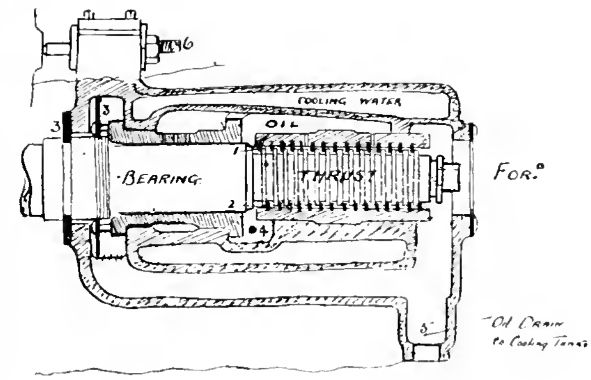
Low speed gives efficiency of propeller.

Even with the propellers of special design, cavitation occurs when the pressure on blades exceeds 12 lb. per square inch, and owing to the fact that their dimensions are limited by available space sometimes, and always by the necessity of revolving at a high speed for the sake of the turbine.

Turbine propellers are generally true screw surfaces, although variations have been adopted in some ships. It is the general opinion that we lack a good design of propeller suitable for use with the turbine.

Disadvantages of the turbine:—

Practically the only disadvantage in a well-constructed turbine is the fact that it is *not economical at low speeds*. This more particularly applies to naval installations where different speeds are required from the same machine, this depending on the fact that the dimensions of rotor and stator are designed in proportion to the steam velocity, and when this is varied efficiency suffers.



Method of Lubricating Thrust and Bearings

The *causes of breakdowns* may be—

Stripping of blades, caused by heated main bearing, causing white metal to run and rotor to drop, or by bad workmanship in setting.

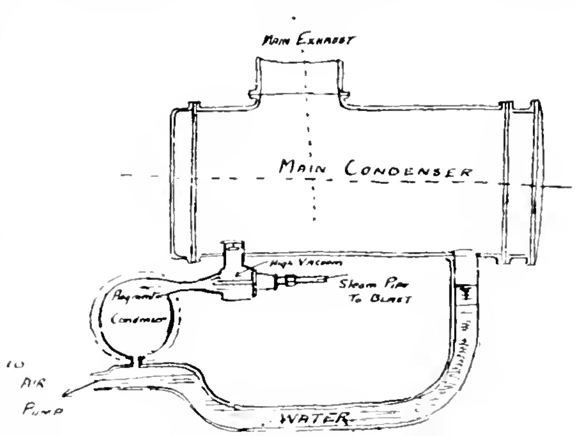
Stopping of rotor, due to neglect of precautions regarding clearance fore and aft when heating up.

Sagging of shaft, due to defective material, vibratory strains or bad design.

Stripping of dummy rings, caused by rotor being out of line longitudinally.

Other faults which may cause trouble are the *corrosion* in the *rotor drums* and wearing of dummy rings, both due to chemical action of air drawn in through the glands.

Advantages.—These are many, among others being: engines *low in* vessel; less *vertical space* occupied; less *weight*, no *vibration* (except immediately over screw); economy *in fuel* (at high speeds); economy *in oil*; *increased H.P.* although *this* as yet can only be approximated by torsion meter.



Method of Fixing Vacuum Augmenter with Wet Air Pump

It seems regrettable that serious faults have been discovered in the design of turbines fitted to large vessels previously. Probably fresh alterations will be devised as experience is added to especially in the method of fixing blades.

It is a tribute to the workmanship of the engineers that serious breakdowns have not yet occurred in connection with turbines. When we consider that the slightest wear in the bearings beyond the clearance allowed on the blades may cause stripping of all the blades of the machine, it is obviously

an important item that the engineers in charge should at all times watch the oil service to see that no clogging has occurred; once the oil heats up it is no easy matter to cool it down quickly, and marine engineers know only too well how often the slackness of the greaser entails the application of the hose-pipe to cool down.

It is found that the wear of turbine bearings is practically *nil*, the rotor tending to float and to wear as much at the top and sides as at the bottom of the main brasses; the thrust also shows no appreciable effect of wear. One test gave $\frac{1}{1000}$th in two years. *The perfect turbine will probably have blading arranged so that separate expansions may be removed and renewed as easily as we can renew piston-rings in ordinary engines.* The case of stripped blading presents an almost impossible problem in event of its occurring at sea (as constructed up to the present). We cannot afford to neglect the human element in a machine where such minute precautions are necessary, and it is certainly necessary that only well-tried and capable men should be entrusted with the care of the turbine.

Institute of Marine Engineers.—We regret that, owing to pressure on our space, we have to hold over the prize essay on "The function of the air and circulating pumps," written by "Vacuum" (Mr. Walter Smith) for the Ritchie award—graduate section.

The Gambetta and Niclausse Boilers.—In the comparative table in the article on the French cruiser *Ernest Renan*, contained in our issue of October, the type of boilers in the *Gambetta* were stated to be of the Belleville type. They are, in fact, of the Niclausse type.

Life Lines.—A petition on the subject of vessels being provided with an apparatus capable of throwing a life-line was recently sent to all members of Parliament by Mr. Gustaf Roos. A copy, which was laid before the King, has been forwarded by His Majesty's command to the Board of Trade. Mr. Roos's aim is to secure the passing of an Act of Parliament to make it compulsory for vessels to carry an apparatus capable of throwing a life-line.

Lloyd's Register Shipbuilding returns for the quarter ended 30th September, 1909.—From the returns compiled by Lloyd's Register of Shipping, it appears that, excluding warships, there were 200 vessels of 778,036 tons gross under construction in the United Kingdom at the close of the quarter ended 30th September, 1909. The tonnage now under construction is about 32,000 tons more than that which was in hand at the end of last quarter, and about 45,000 tons more than that building twelve months ago. Of the vessels under construction in the United Kingdom at the end of September, 217 of 496,689 tons are under the supervision of the surveyors of Lloyd's Register with a view to classification by this Society. In addition, 59 vessels of 169,293 tons are building abroad with a view to classification. The total building at the present time under the supervision of Lloyd's Register is, thus, 276 vessels of 665,982 tons.

The Institution of Civil Engineers.—The Council have made the following awards for the year 1908-1909:—*Telford Gold Medals* to Prof. B. Hopkinson, M.A., B.Sc. (Cambridge), and Mr. G. R. G. Conway (Monterrey, Mexico); *Watt Gold Medals* to Messrs. D. A. Matheson (Glasgow) and W. C. Popplewell, M.Sc. (Stockport); *George Stephenson Gold Medals* to Messrs. E. H. Tabor (London) and A. J. Knowles, B.A. (Cairo); *The Indian Premium* and a *Telford Premium* to Mr. T. R. Nolan, B.E. (India); *Telford Premiums* to Messrs. S. J. Reed (Newcastle), C. T. Purdy (New York), L. A. R. Wade (Sydney), G. Hobbs (Accra, West Africa), W. Cleaver (Port Talbot), J. D. W. Ball (London), Prof. A. H. Gibson, D.Sc. (Dundee), and R. D. Gwyther, M.Sc. (Buenos Aires); *The James Forrest Medal* and a *Miller Prize* to Mr. J. A. Wotherspoon (Glasgow); *The Miller Scholarship* to Mr. J. A. Orrell (Manchester); *The James Prescott Joule Medal* and *Miller Prizes* to Messrs. W. E. Fisher and E. B. Wood (London); *Miller Prizes* to Messrs. W. E. R. Gurney (London), E. G. L. Lovegrove (London), J. Purser (Birmingham), G. C. Minnitt (Manchester), S. F. Deacon (Manchester), C. H. Bradley and A. E. Marshall (Birmingham). The first ordinary meeting of the session 1909-1910 will be held on November 2nd, at 8 p.m.

FEED HEATING.*

The advantages accruing from raising the temperature of the feed water between the hotwell and the boiler must be considered both in relation to the increased efficiency of the steam generator, and to the utilization of such waste heat as is available in the funnel and in the exhaust pipes.

Irrespective of the thermal gain from the engine, the reduction in temperature difference at the check valve has a beneficial effect upon the boiler. If cold feed be introduced, it tends to gravitate to the bottom, due to its greater density, an effect which is both inimical to good circulation and a productive source of internal strain. The velocity of the convection currents is obstructed by this accumulation of dead water, where there is no direct heating agency to promote an upward flow to the warmer parts of the boiler, and unless some subsidiary means are adopted for inducing motion, the continual income of feed water will maintain this cold region below the furnaces, requiring the absorption of heat from the warmer upper layers. Although the spraying of the feed from an internal pipe assists in preventing this deposition, and allows of its being heated more readily in its downward flow, the less the heat required to raise it to the vaporization temperature, the more assurance is there of cold water neither collecting in this manner nor impeding circulation.

Upon this aspect of deficient circulation it is not perhaps a digression to enlarge, but although the heater may be a means of dispensing with a circulator, this is not the prime cause of introducing the feed water at nearly boiler temperature. The formation of steam bubbles occurring during direct contact with the hot plate requires a continual flow of water against the plate, and the faster the flow the more rapidly will steam be generated, but as the rate of flow depends on the speed of the particles, and this in turn upon the temperature, the incoming of colder water by abstracting energy from the warmer particles reduces the speed of the circulating currents and retards the production of steam.

The temperature difference which occurs between the top and bottom of the boiler shell, due to the body of dead water, tends to militate against uniform expansion of the structure, with the consequent result of weeping seams and rivets, as well as fatigue of the material, and is a source of greater trouble than is perhaps often realized considering the forces exerted by expanding metals. There is a side issue to this inlet of cold feed, namely, corrosion, which may be resultant from greater aeration of the water, or from the galvanic action induced by temperature differences in adjacent portions of plate producing variations in electric potential in an acid or saline state of the boiler water. This corrosion has been particularly noticeable where the incoming water impinges on a metallic surface, or where the joint of the internal pipe on the shell is leaking.

Such feed heating apparatus as have been applied to remedy these defects, simply with reference to the boiler, are those where direct heating with live steam is employed or where internal heaters are used, the feed in the latter case being passed through a series of tubes in the steam space before introduction to the boiler proper. The gain effected by both these methods in boiler operation and maintenance has fully warranted their installation, proving that on these considerations alone feed heating is commercially justifiable and expedient.

With regard to the waste heat passing up the funnel this is available for either superheating or feed heating, and with the exception of draught production is otherwise a dead loss at a temperature of from 600°F. upward. Although neither of these purposes has so far met with too favourable a reception for ship work, the economic gain effected in land installations with such as Green's economizer has demonstrated that there is an undeniable profit to be secured by tapping this source, where the conditions of operation render it practicable.

Figures given for this type of heater with W.P. at 58 lb. per square inch, flue temperature 618°F., initial and final temperature of feed at 58° and 225·2°F. respectively, give a

*Prize Essay by "Enigne" (Mr. W. W. Adamson), Associate, Institute of Marine Engineers, written for the Stephen Award—Associate Section.

saving of 28·9 per cent., a pungent criticism of the inefficiency of the boiler. This method offers, however, a higher temperature than is attainable elsewhere, every degree of which is heat lost to the boiler, although essential, more or less, to the speed of the hot gases upon which the rate of heat transference is so dependent.

With a terminal pressure in the L.P. cylinder of 7·5 lb. per square inch abs. at a temperature of 180°F., there is a range of 60° to the hotwell at 120°F., and an available latent heat of 990 B.T.U's. per pound of steam. From this there is the deduction due to lowering of exhaust pressure in the eduction-pipe to the condenser, necessarily consequent upon avoiding a high back pressure where every pound per square inch is worth seven in the H.P. cylinder, but an ample margin of heat units remains, although at a comparatively low temperature. There are also the auxiliary exhausts, at terminal pressures considerably higher, such as fan, electric and steering engines, independent feed and circulating pumps, other auxiliaries and evaporator steam, which are available for raising the temperature, although in general unable to provide all the required heat, further steam being taken either from intermediate stages in the main engines or from the boilers.

The expression used for estimating the gain in fuel by exhaust steam heating, as in the non-condensing engine, is rendered as a percentage by

$$\frac{100\,(T-t)}{H-t}.$$

Where T is final temp. of feed water.
Where t is initial temp. of feed water.
Where H is total heat in steam in boiler.

This represents the fraction of lost work in the steam escaping into the atmosphere which is returned to the boilers per pound of feed. There is, however, still the loss from the steam which is in excess of the heat-absorbing power of the water.

Where steam is taken at the pressure in the L.P. receiver, either from the main or auxiliary engines, the total heat assured simply at 14·7 lb. per square inch is 1146 B.T.U's., and with initial and final feed temperatures at 120°F. and 212°F. respectively, the total water available to feed the boiler at this temperature will be, per lb. of steam, $\frac{1146}{212-120} = 12{\cdot}4$ lb., or an approximation of eight per cent. of the total steam at this pressure is required to heat the feed. In large modern installations the steam consumed by the auxiliaries is very nearly this in amount, and little further heat is required from the L.P. engine, but for the smaller class of steamer the percentage is considerably less and main steam is necessary. From this must be deducted losses in the heater and the lost work to the engine and auxiliaries, less the saving in air-pump and condenser duty, the function of the steam being to work, not to heat, although the engine is less efficient than the heater in its utilization of the steam.

Transference of this exhaust heat to the feed water may be effected either by means of a simple pipe coil in the eduction pipe, an external tubulous surface heater, or by direct contact. The first of these is a simple contrivance, of moderate efficiency, where the exhaust temperature is sufficiently higher than the hotwell, and the drains and auxiliary exhausts are led directly upon it. The surface heater takes the form of a condenser; the feed from the pumps passing through the tubes at high pressure is surrounded by exhaust steam draining to the hotwell. This heater is suitable for turbine engines, in which it is undesirable to take main steam where low terminal pressures can be economically attained, while a relatively greater quantity of heat is available from the pumping engines and other auxiliaries. The tube surface is, however, rendered inefficient by the slow bucket speed of the pumps, and on the steam side baffles are necessary to direct the steam flow. In some cases this is reversed in construction. The direct contact method possesses one difference from the surface heater, namely, the spray extraction of the corrosive agents, oxygen and carbon dioxide occluded in the water, a valuable adjunct which is one of the principal features of the Weir heater.

In this apparatus the heating steam is led through a non-return valve on the side of the cylindrical body, and from an annular space passes through a perforated cylinder into the waist of the heater. The feed water is forced through a spring loaded valve on the cover, at a pressure of a few pounds per square inch, breaking into a fine spray as it passes through the valve orifice, thus freeing the water particles from the dissolved gases; the water, falling through a perforated cone, mingles with the incoming steam, and the mixture of heated water and condensed steam collects in a float tank in the base of the heater. A dome, fitted on the cover, with an atmospheric escape valve, has a cock connection leading to the condenser, as a bye-pass for the separated air; the heater by working at low pressure promotes the de-aeration of the water, which is further assisted by the heating action.

The basis of the thermal gain is in the realization of the latent heat which would otherwise be discharged overboard in the circulating water, and to secure this economy at a maximum the steam should be taken after passing the L.P. cylinder. If, however, steam is taken from the L.P. receiver, as is generally done with greater convenience in meeting the auxiliary exhaust pressure and temperature, then energy available for mechanical work is being abstracted, and unless the heat in the main drains is returned direct to the hotwell, instead of down the piston rods or into the condenser, there is a loss from the steam entering the H.P. casing by valve leakages and condensation. In other words, the steam in the L.P. receiver is nett energy available in the L.P. engine for work, deductions having been made from the gross energy supplied from the boilers by the mechanical and thermal imperfections of the engine, which are greater in the initial stages of the steam path on account of higher temperature, pressure and speed differences. Where steam is taken from the L.P. receiver, then the expansion gear must be so arranged that, relatively to the other cylinders, no reduction is made in the initial load on the L.P. piston, in order to maintain the greater designed load required by the inertia of the heavier parts.

From the auxiliary exhausts a gain is effected, both in sensible and latent heat, due to the high terminal pressure, although a greater back pressure is produced by communication with the L.P. receiver than where the exhaust is direct to the condenser. Where boiler steam is used for heating, the sensible heat available for work and the accompanying latent heat are not directly gained, as the latter would otherwise have been the conveyer of sensible energy through the engine. A high-feed temperature being, however, distinctly advantageous to the boiler, so far warranting the use of live steam, there would appear to be sufficient assurance for further exploitation of the internal heater already referred to, even in conjunction with the external and lower temperature method.

By heating the feed in the steam space, complications of joint leakages and radiation losses are avoided while still retaining the advantages of the live steam heater. It would appear on the surface that the means adopted simply result in debiting the steam to credit the water; but as it is so vitally important that circulation should not be obstructed, and the water must in any event be raised in temperature by the boiler, it becomes expedient to utilize the heat available where, owing to the extreme vibration of the particles, the heat transference is unaffected by circulating currents. Further, the flow of the water discharged from through the check valve is certainly better heated by remaining in the steam space than is the flow of feed downwards in the water space, the speed of the steam particles being immeasurably greater than that of the boiler water particles, the rate of heat transference is more than probably greater than where the feed is simply sprayed into the boiler.

It might appear that wet steam would result by this interpolation of water tubes, but unless the heater be placed directly in line with the outflow from the stop valve, there are reasonable suppositions to negative this. If a film of moisture collects upon the external surfaces of the heater tubes, steam particles may either be trapped or rebound, and the accumulation of steam condensing will form globules at a surface tension, which allows of their falling into the water space of the boiler. An aid to efficiency of the tubes is obtained, as in other surface heaters, by roughening or grooving the surface, provided that no corrosive agency is induced by abnormal disturbance of the protective skin. The live steam external heater offers the advantage that the thermometer is readily applied to make the resulting temperature obvious, but the insertion of a thermo-electric couple in the internal heater places it in an equivalent position.

With gas engine-electric driven auxiliaries there is available for the feed of the main engine boilers the heat from the cooling chambers and from the exhaust portent of the contest

of the boiler with the producer for the last seam of coal or a place in the museum as a relic of the steam age.

A summary of the thermal, operation, and maintenance economies is difficult of estimation, where conditions of working must necessarily greatly vary, and a saving which appears attributable to feed heating may possibly have been enhanced or depreciated by some contributory cause. There is no incredulity towards feed heating on account of its being one of a large number of expedients and devices, which seemingly may eventually result in reversing the usual order of things, and make it possible to take coal from the furnace to fill the bunkers; but from its state of probability, which was once voiced in earlier days as being "a good thing for the boilers, but in economy not so apparent," it has eminently emerged to a finality of judgment which has made it a necessity for the boilers with an economy both apparent and real.

THE COWPER-COLES ENGINEERING CO., LTD. has been awarded, by the juries for the different sections of the Imperial International Exhibition, a Diploma for Grand Prize in connection with their Metallurgical and Electro-Chemical Exhibits, and a Diploma for Gold Medal for Mechanical Engineering, also a Diploma of Honour for Applied Chemistry.

THE MANCHESTER ASSOCIATION OF ENGINEERS.—The opening meeting of the session of the Manchester Association of Engineers was held on October 9th, when Mr. Joseph H. Stubbs delivered his inaugural address on "Engineering efficiency." A paper on the "Exhaust steam turbine" will be read on November 13th by Mr. J. N. Bailey.

INSTITUTION OF MECHANICAL ENGINEERS.—HEAT TRANSMISSION.—The opening meeting of the session of the Institution of Mechanical Engineers was held in the hall of the Institution at Storey's Gate on October 15th, Mr. J. A. F. Aspinall, president, in the chair. Professor W. E. Dalby brought before the Institution the results of a research into the present state of knowledge concerning the transmission of heat across boiler heating surfaces. He pointed out that the work, in which he had received valuable assistance from Mr. H. C. A. Thieme, had involved the reading of over 500 papers on the subject, abstracts of which had been prepared, and were available for reference in the library of the institution. There were three methods of heat transmission in a furnace which acted simultaneously from the flame to the water—transmission by radiation, by convection, and by conduction. It was extremely difficult to analyse the results of experiments so that the heat transmitted by each of the three methods might be stated separately, and the more nearly any formula expressed the real physical laws involved in the transmission, the more complicated it became, owing to the inclusion of the necessary constants and variables. It had to be admitted that there was a general absence of information bearing on the subject of the phenomena which occurred in a steam boiler when working under the ordinary conditions of practice, and the result was seen in stagnation design. The steam engineering division of the technological branch of the United States Geological Survey had carried out some tests at a cost of 100,000 dollars (£20,000). The effect of varying the initial temperature and the flue dimensions was studied, together with the relation between the velocity of the air passing over the heating surface and the rate of heat transmission. It was shown that the heat absorbed by the boiler varied almost directly as the calculated velocity of the air, but it was demonstrated that the rate of heat absorption did not rise as fast as the increase of initial temperature. A complete set of experiments had been carried out by Professor Goss on a locomotive boiler. Professor Nicolson, as the result of experiments on a Cornish boiler, had recommended radical changes in boiler design. Additional research was clearly called for, and he suggested that the Institution should initiate a research in which steam boilers of different types, working under practical conditions, should be made the subject of experiments, in which all the elements of their working were measured, together with their temperatures, for the purpose of establishing the temperature gradients at different parts of a boiler directly.

THE VIBRATIONS OF SHIPS AND THE USE OF A DYNAMICAL MODEL FOR DETERMINING THE ELASTICITY OF SHIPS.*

By Professor J. B. HENDERSON, D.Sc.

PART I.

THE ELASTICITY OF SHIPS AS DEDUCED FROM EXPERIMENTS ON THE VIBRATION OF DYNAMICAL MODELS.

THE experiments recorded in the following pages form part of some experiments on vibrations of elastic structures carried out during Sessions 1906-7 and 1907-8 in the Engineering Laboratory of the Royal Naval College, Greenwich, by some of the third year students. To the zealous perseverance of Messrs. E. B. Harries, F. L. Mayer and A. W. Watson (now all members of the Royal Corps of Naval Constructors), belongs the credit of overcoming the experimental difficulties, and of carrying out the experiments on the model of the first ship; the experiments on the second ship were carried out by Messrs. J. Coote, W. B. Hugman, and T. L. Mathias, and were also brought to a successful issue.

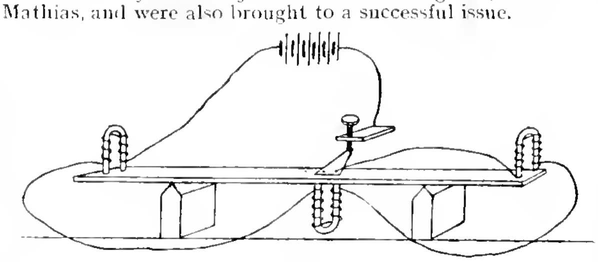


Fig. 1.

The first set of experiments was undertaken with the view of verifying the theory of the vibration of uniform rods. A steel straight edge of rectangular section 36·1 in. by 3·0 in. by 0·45 in. weighing 14 lbs. was supported at two nodes and vibrated electromagnetically, as shown diagrammatically in Fig. 1. The electromagnets were placed alternately above and below the bar, and therefore forced it to vibrate in a definite mode; and the current to the magnets was "made" and "broken" by the vibration of the bar itself, just as in an electric bell. The frequency of vibration of the bar was measured stroboscopically, and, although several arrangements of stroboscope were used, only the final one will be described. It has the great advantage over the others that the experimenter sees at once whether the stroboscope disc is going too fast or too slow for synchronism, and can adjust accordingly—thereby ensuring a very high order of accuracy in determining the frequency. Fig. 2 shows the arrangement. The short-focus lens L, which is fixed to the vibrating

Fig. 2

bar B, forms a small image of the stroboscopic disc in front of the objective of the low-powered microscope M. The microscope is focussed on the image of the top or bottom edge of the slots in the disc. The stroboscopic disc is driven by a direct current motor, and the speed of the motor is measured by a revolution counter mounted directly on the spindle. With this arrangement of stroboscope, when the disc is rotating at synchronous speed, *i.e.*, one slot crossing the field of view in one period of the bar's vibration, the experimenter, on looking through the microscope, sees the edge of a disc whose periphery has a wavy form. If the speed of the disc is double the synchronous speed, then one sees two such discs superposed with the edges differing in phase by half a wave length, and so on. Of course, it is necessary to exclude all direct illumination from the image of the disc. If the speed is slightly above or below synchronism, the waves appear to move to right or left, according

* Read at the Fiftieth Session of the Institution of Naval Architects.

as the speed deviation is in one direction or the other, and the experimenter has no difficulty in maintaining the same wave continuously in the field of view for five minutes at a time, if he has at his command a sufficiently fine adjustment on the speed of the motor.

Experiments were carried out with the bar vibrating in its fundamental mode, and in its first, second and third harmonics, with 2, 3, 4 and 5 nodes respectively in the length. The positions of the nodes were obtained by scattering sand on the upper surface, and the two supports were always placed so as to coincide with two nodes.

The results of the experiments are given in the table on the following page, which shows also a comparison between theory and experiment.

VIBRATIONS OF SHIPS.

The vibrations of the uniform bar having shown a satisfactory agreement between theory and experiment, and the apparatus being ready for the study of the vibrations of any elastic structure, it was decided to obtain the periods of vibration of a ship by means of her dynamic model, as was done by Mr. A. Mallock. By a dynamic model is meant a beam or girder which has a load curve similar to the load curve of the ship, and a curve of moments of inertia of sections about the neutral axes similar to the corresponding curve for the ship. The scale for the load curve does not require to be the same as the scale for the moment of inertia curve.

No. of Nodes.	Frequency of Vibration. Complete periods per second.		Distance of nodes from nearer end, measured in fractions of the length.	
	Experiment.	Theory.	Experiment.	Theory.
2	72·25	72·3	0·224	0·2242
3	200	201	0·130, 0·5	0·1321, 0·5
4	394	394	0·094, 0·358	0·0944, 0·3558
5	649	651	0·073, 0·277, 0·5	0·0735, 0·277, 0·5

The period of vibration of a beam will depend on s, the stiffness of the beam in bending (which is proportional to I E) on μ, the mass of unit length, and on l, the length of the beam. Writing

$$T \propto s^p \mu^q l^r$$

and equating the dimensions of the two sides, we find (since s has the dimensions $\left(\frac{M L^3}{T^2}\right)$

$$p = -\tfrac{1}{2},\ q = \tfrac{1}{2},\ \text{and } r = 2.$$

$$\therefore T \propto l^2 \sqrt{\frac{\mu}{s}} \propto l^2 \sqrt{\frac{\mu}{I E}}.$$

We might have obtained this equation from the mathematical equations of motion, or from the final solution of these for the period of vibration in any mode of vibration; but it is simpler to deduce it from the fundamental conceptions of the physical phenomena, although the application of dimensional methods has to be carefully used. Hence, writing large letters for the ship and small letters for the model, we have the ratio of the two periods given by

$$\frac{T}{t} = \frac{L^2}{l^2} \sqrt{\frac{M}{\mu}} \sqrt{\frac{i\ e}{I\ E}}.$$

Hence, if we know the periods of both ship and model, we can deduce the elastic properties of the ship; or, if we assume E for the ship, we can calculate the period of the ship from that of the model.

H.M.S. *Pathfinder* was chosen, for which the curve of weights had been worked out with great accuracy and for which the curve of moments of inertia of a number of different sections had also been calculated. She is a scout of about 3000 tons displacement. The condition of lading corresponded to the bunkers being about half full of coal.

A dynamic model of the ship was made from a bar of steel of uniform thickness, 48 in. long, ¾ in. thick the breadth being varied so as to give the correct relative moment of inertia for every section. Since the moment of inertia of the section is simply proportional to the breadth, it is sufficient to make the breadth directly proportional to the ordinates of the moment of inertia curve in order to have the beam to scale as regards the stiffness. The scale of loads is then fixed by the section which has minimum ratio of load to moment of inertia, since at this section we want the weight of the bar itself to represent the load, and at all other sections we can add lead weights to bring up the mass of unit length to the corresponding amount on the ship. Thirty lead weights were necessary to bring the loads to correspond with the load curve of the ship, and these were soldered to the bar. It was anticipated that soldering these masses of lead over a considerable portion of the length of the bar would stiffen it considerably; but experiments made with the lead continuous, and also with it cut up into very short lengths, showed no marked alteration in the period of vibration. Hence the lead cannot contribute to the stiffness to any appreciable extent.

The scale of weights was found by weighing the finished model, and the position of the centre of gravity of the model was found to be less than 0·25 per cent. of the length of the model from the correct position as calculated in the ship.

In order to force the bar to vibrate by means of electromagnets placed alternately above and below the bar, the lead weights had to be soldered at some parts of the length above the bar, and at other parts below it, so that the magnetic pull might come directly on the bar with as small an air gap as possible, and with no lead between the magnets and the bar. Sufficient vibration was always obtainable to determine the nodes, whether the supports were near or far from them; but, in the determination of the frequency, the supports were always moved so as to coincide with two nodes.

Experiments were carried out with the model vibrating with two and also with three nodes in the length, and the results are given in the following table.

VIBRATION OF THE DYNAMIC MODEL OF H.M.S. "PATHFINDER."

No. of Nodes	Frequency—Complete Periods per Second	Positions of Nodes in Fractions of the Length from the Bow
2	81·8	0·280, 0·728
3	194	0·179, 0·515, 0·832

The frequency of the model with three nodes is 10 per cent. greater than double the frequency with two nodes, but 14½ per cent. less than it would be if the periods follow the same law as in the uniform bar.

If the modulus of elasticity of the ship were equal to the modulus of the bar, the scales of the ship and model are such that the frequency of the ship would be 127 per minute. Unfortunately no pallograph records are available for this ship, but I am indebted to the Admiralty and to the officers of the ship for carrying out some experiments on her vertical vibrations. They report that the frequency of vertical vibration is 106 per minute when the engines are running at 100 revolutions per minute. Hence the modulus of the ship must be less than that of the model in the ratio—

$$\left(\frac{106}{127}\right)^2 = 0·70$$

i.e., 30 per cent. lower. Taking E for the model as

$$30 \times 10^6 \ \frac{\text{lbs. wt.}}{\text{in.}^2}$$

gives E for the ship as

$$21 \times 10^6 \ \frac{\text{lbs. wt.}}{\text{in.}^2}$$

VIBRATION OF TURBINE STEAMER.

The first set of experiments having been carried out on the model of a gun-boat, it seemed desirable to repeat the experiments with another type of ship, and preferably with one whose period of vibration had been accurately determined. The writer is very much indebted to Messrs. John Brown and Co., and the joint managing directors, Messrs. Chas. E. Ellis and J. G. Dunlop, for the data regarding the turbine steamer *Lusitania* which enabled her model to be constructed, and also for the pallograph records of her vibrations at sea. The dynamical model was made 48 in. long, ¾ in. thick and with a maximum breadth 5·1 in.

The results of the experiments are as follows:—

VIBRATIONS OF MODEL OF TURBINE STEAMER.

No. of Nodes.	Frequency. Periods per Second.	Positions of Nodes from Bow in Fractions of the Length.
2	72·55	0·26, 0·76
3	182	0·153, 0.53, 0·853
4	350	

The frequency of the model, according to the scales chosen, should be 58·4 times the frequency of the ship. Hence for equal moduli the fundamental frequency of the ship should be

$$\frac{72\cdot5}{58\cdot4} = \frac{1\cdot244}{\text{sec.}} = \frac{74\cdot6}{\text{min.}}$$

The actual frequency of the ship is 65 per minute; hence the ratio of the elasticity of the ship to that of the model is—

$$\left(\frac{65}{74\cdot6}\right)^2 = 0\cdot761,$$

or the elasticity of the ship is 24 per cent. less than that of the model. This gives a value of E for the ship of

$$23 \times 10^6 \frac{\text{lbs. wt.}}{\text{in.}^2}$$

This value is greater than was obtained for the *Pathfinder*, but the plating in the scout is very much thinner than that in the liner. Thin plates, are, as a rule, more buckled than thick plates; and, since the buckles straighten out when a pull stress comes on them, the thin plates must give a lower modulus in vibration than the thick plates, because, when a plate straightens under pull stress, it is equivalent to an increase of strain for the same stress.

An objection may be raised against the comparison of ship and model in that the model vibrates freely in air, while the ship vibrates in water, and has its vibration considerably damped. We are dealing, however, with the forced vibrations of the ship, due to a periodically applied force arising from rotation of the screws or other machinery on board, and such forced vibrations, when damped, always reach the maximum amplitude if the periodicity of the exciting disturbance agrees with the natural free period of the vibrating structure. In ships the amplitude of vibration is, as a rule, negligible, unless there is approximate equality in the period.

In addition to its damping effect on the vibrations the water has another effect, especially when the period of vibration is very slow, for then the water will move in stream-line motion backwards and forwards along the bottom past the nodes, as one portion of the ship rises and the neighbouring portion sinks. This mass of moving water is equivalent to an increase of the mass of unit length of the ship, and would tend to raise the values of E which we have deduced for the ship. The more rapid the vibration the less must this effect be. Experiments show that the virtual mass of a body rotating in a fluid is very much less than the virtual mass of the same body moving through the fluid, and we would anticipate that the virtual mass in vibration would be still less than in rotation. It is important to remember that this effect is present although of small magnitude, and that its influence would be to raise the value of E. It would probably have no greater influence than the quantities which are neglected or allowed for roughly in the calculation of the moments of inertia of the ship.

In calculating the moments of inertia the practice is to neglect the wooden decks or sometimes to add $\frac{1}{25}$ of their thickness to the steel decks below them. This was done in the case of the *Pathfinder*. In strength calculations the wood of the deck would only contribute to the strength of the ship in sagging, and not in hogging; but in vibration it would always contribute to the stiffness, since the fastening between wooden and steel decks is quite sufficiently strong to take the small shear stresses introduced by the vibration. It is also customary to neglect the intercostal girders in calculating the moments of inertia. These girders may not contribute much strength to the weakest sections of the ship, but they certainly contribute to the stiffness of the ship as an elastic structure. Hence the values of I in the usual moment of inertia curve are too low for vibration experiments. We ought therefore to increase the ratio of I to *i*, which would reduce the value of E for the ship. Hence this omission varies E in the opposite sense to that in which the inertia of the water would vary it. Lastly, it may be observed that the elasticity in vibration is the kinetic or adiabatic elasticity, while the value of E taken is the isothermal or static modulus. The connection between the two was given many years ago by Lord Kelvin, and the difference, which amounts only to 0·2 per cent., is negligible for practical purposes. It is the writer's opinion that the method here adopted of vibrating a dynamical model of a ship, bridge, or other elastic structure forms a convenient practical method of deducing the period of vibration of the structure itself, and where that period has been experimentally obtained it forms a convenient method of obtaining further information regarding the elasticity of riveted structures.

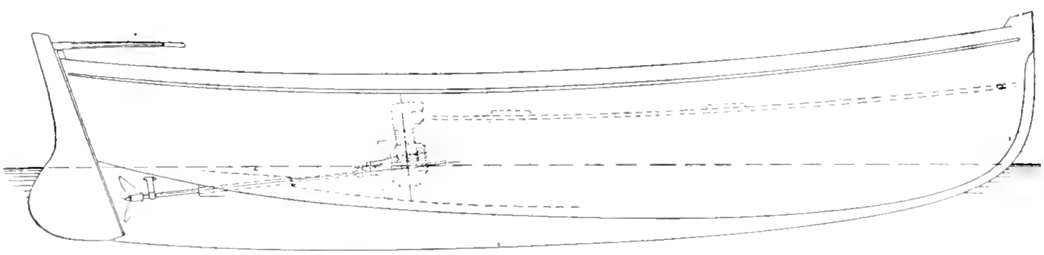
To be continued

MESSRS. DENNY, MOTT & DICKSON'S, LIMITED, wood market report states that business recently has been generally dull and depressing. Nevertheless, all holders of stock feel to be on very safe ground, as even the present rate of enquiry is sufficient in proportion to the bulk of the stocks held, whilst if the improvement in the demand, which certainly commenced during the summer, resumes its course on the settling down of the political disquiet which has since arisen, the course of prices must continue to tend upwards; the more especially as there are sensible indications of a rapid increase of business in the United States which should have the usual effect of stimulating business on this side.

THE JAPANESE EXHIBITION (1910).—Under the auspices of the Imperial Government of Japan and with the cordial approval of the British Government, arrangements have been completed for a great Japan-British Exhibition to be held next year at the White City, Shepherd's Bush. In view of the alliance between Great Britain and Japan no conjunction could be happier. At the inaugural banquet held recently, when a distinguished company assembled, messages were read from His Majesty the King and His Imperial Majesty the Emperor of Japan expressing their desire for the success of the undertaking. The Japanese section promises to be most interesting as well as instructive. It will be divided into eighteen groups, relating to (1) education, (2) fine arts, (3) liberal arts, (4) mechanical engineering, (5) electricity, (6) civil engineering and transportation, (7) agriculture, (8) horticulture, (9) forests, sport, fishing, etc., (10) alimentation, (11) mines and metallurgy, (12) decoration and furnishing, (13) textiles, (14) chemical industries, (15) various industries, (16) social economy, (17) colonization, (18) armament, etc. As will be expected, however, the most fascinating part of the great Exhibition will be its section of art, and some distinguished connoisseurs are organizing an exhibition of ancient as well as modern arts. As there are very few opportunities, even in Japan, of witnessing really good exhibitions of this kind, the rare and valuable specimens of ancient art being mainly in the possession of noblemen's families or of collectors and very seldom shown in public, the display in the Fine Arts Palace will be unprecedented, and will afford experts in this country a very unique opportunity for studying Japanese art. Among some of the exhibits by the different Government Departments may be mentioned the following:—Model of Todaiji Temple at Nara, the ancient capital of Japan; plans showing harbour improvements at Yokohama and Kobe; models of the battle ground at Port Arthur; models of Japanese men-of-war, showing the development of the last half century; exhibits showing the different stages of educational institutions, and models of ships of different ages. The Japanese Gardens will naturally be a special feature of the Exhibition. The unique character of the Exhibition cannot fail to increase the commerce of the two nations and to create new commercial channels between them and the rest of the world, and the committee appeals to the manufacturers and producers of this country, as well as those of the rest of the British Empire, to rise to the occasion by displaying the best of their respective productions in arts and industries, so as to make a representation worthy of this great opportunity.

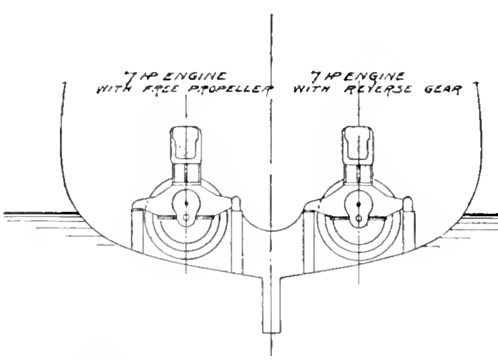
MARINE MOTOR NOTES.

Messrs. The Parsons Motor Company, of Town Quay, Southampton, have recently carried out a rather uncommon type of installation of motor power in a fishing launch which has been built by Messrs. Ashton & Kilner, of Poole, for service in the Channel Islands. The launch is equipped with twin engines and is of the following dimensions:—Length, 25 ft.; beam, 7 ft. 6 in.; draught, 2 ft. 2 ins. Each engine is of 7 h.p., and both can be run on petrol or paraffin as desired, tanks being fitted for both fuels; also each engine, with its installation and controls, tanks, etc., is entirely independent of the other throughout.



Motor Installation in Fishing Launch.

The port engine is fitted to go astern as well as ahead by reverse gear, but the starboard engine is one of the Parsons Company's standard special auxiliary sets, and allows for go-ahead only, with the Company's well-known free-propeller system disengaging the propeller, the result being that the launch can be cruised at low speed with one engine which provides astern motion when necessary, whilst the propeller of the other engine revolves freely without drag. When both



Motor Installation in Fishing Launch.

engines are running at full power the speed is rather over nine miles per hour. The launch has proved herself extremely seaworthy and quite suited for the work round the Channel Islands for which she has been specially designed.

The illustrations show a profile of the launch and a cross section in way of the machinery, from which it will be gathered that the launch is a very roomy craft and has a large freeboard, which makes it possible to work her comfortably in open water.

The motors are inclined, as shown, to enable the propellers to work in "solid" water, and, as will be seen from the cross section, the engine seating is of substantial design and of ample proportions to withstand all the strains likely to come upon it when working in the open sea.

The installation occupies comparatively a very small space in the after-end of the launch, and the various control handles, etc., are conveniently arranged so as to be well within the reach of the helmsman without him having to leave the tiller, which is an important consideration.

Messrs. Summers & Payne, Ltd., Northam.—A new 22-feet motor launch for *Julnar* r.y.s. (135 tons ketch), Sir Maurice FitzGerald, Bart., is being laid down to replace the boat lately sunk at Cowes.

Motor Boat Burned.—The motor racing boat *Lethe*, owned by Mr. White, of Ramsgate, was recently burnt to the water's edge off Deal, the cause of the fire being, it is understood, an explosion in the petrol tank. The crew were rescued by the Deal lifeboat.

Tyne Motor-Boat Service.—The number of boats in this service has been increased to four, and will be augmented still further if necessary. They are at present petrol-driven boats.

MARINE BOILER EXPLOSIONS.

From the Board of Trade Reports.

Report No. 1850 deals with the explosion from the boiler of the steam drifter *Test*, which occurred when at sea about 105 miles W.S.W. from St. Ann's Head, St. George's Channel. No person was injured by the explosion. The boiler, which is made of steel, is of the ordinary cylindrical, multitubular, single-ended, marine type, and is fitted with one plain furnace. The safety valves were loaded to a pressure of 102 lbs. per square inch. The explosion occurred from a small hole, about $\frac{5}{8}$ inch by $\frac{1}{32}$ inch, in the front plate of the boiler, at the bottom, close to the landing edge of the shell plate. The cause of the explosion was that the plate was locally wasted externally, at the part which gave out, where the plate was reduced from the original thickness to practically nil. The observations of the Engineer Surveyor-in-Chief were as follows:—The explosion in this case was not of a serious character, and arose from the local corrosion of the boiler plate consequent on its contact with wet ashes, the extent of the wastage having apparently escaped observation when the defective part was last examined, owing, it is suggested, to the plate being insufficiently cleaned to admit of a thorough inspection.

Report No. 1851 deals with the explosion from the boiler on board the steam trawler *Amroth Castle*. No one was injured by the explosion. The boiler is of the ordinary cylindrical multitubular type, being 10 ft. 6 in. in diameter and 10 ft. in length. The boiler was designed for a working pressure of 160 lbs. per square inch and appears to be made of steel throughout. The crown plate of the starboard combustion chamber collapsed, the tube and back plates were bent inwards at the upper part, and the girders had their positions correspondingly altered. Six of the nuts were burnt off the supporting stays and the crown plate was forced

partly or completely over the stay ends, permitting the escape of steam into the combustion chamber. The pressure of steam in the boiler at the time of the explosion was about 120 lbs. per square inch. The explosion was due to the water in the boiler having become too low, causing the stay ends, nuts, and the crown plate to become overheated to such an extent that they were unable to resist the pressure of the steam in the boiler. The observations of the Engineer Surveyor-in-Chief were as follows :—In this case the combustion chamber crown plate of a boiler in a trawler collapsed owing to overheating, arising from shortness of water. Those in charge of the boiler appear to have been quite unconcerned regarding its safe working and as to whether there was sufficient water in the boiler or not; and as long as boilers are neglected in this manner, similar occurrences may be expected. Fortunately no one was injured.

Report No. 1852 deals with the explosion from the main steam pipe on board the steam trawler *Marion*, which occurred when the vessel was about 260 miles west of Lundy Island, Bristol Channel. No person was injured by the explosion. The pipe was made from a solid drawn copper tube, $3\frac{1}{2}$ in. in internal diameter, No. 7 legal standard wire gauge in thickness, and about 5 ft. 3 in. in length. The ends of the pipe were fitted with brass flanges, brazed on in the usual manner. The pipe cracked, circumferentially, for a distance of $\frac{1}{2}$ in., at the neck of the flange at the after side next the engine stop valve, and steam escaped into the engine-room. The fracture subsequently extended until it was 4 in. in length. The explosion was due to the pipe being unable to withstand the stresses set up by the vibration of the engines when racing heavily, in a short choppy sea. The observations of the Engineer Surveyor-in-Chief were as follows :—The pipe which failed was dealt with in a previous report, when it fractured at about the same position as in the present instance. To provide for the movement of the pipe under working conditions, an expansion joint was subsequently introduced to the range, but it does not seem to have wholly fulfilled expectations, and has now been removed and a new pipe fitted with more elastic bends, which it is hoped will provide sufficient flexibility to prevent the recurrence of similar failures.

MERCANTILE MARINE SCHOLARSHIPS.—The L.C.C. is proposing to award two mercantile marine scholarships valued at £40 each, which will cover the cost of two years' training on the Marine Society's training ship *Warspite*. Accepted candidates will be apprenticed to the Society for two years, which will be spent on board the *Warspite*. At the end of this time they may be apprenticed at sea for three years. During the second year on the ship the boys receive 3s. 6d. a week in wages for the first six months, and 5s. a week during the last six months.

THE NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—The twenty-sixth annual meeting of the Institution was held in the Lecture Theatre of the Literary and Philosophical Society, Westgate Road, Newcastle-upon-Tyne, on Friday, October 29th. The paper on "Notes of marine boiler design, construction and economy," by Mr. D. Myles, vice-president, was read. The second general meeting of the session will be held in Sunderland, on Friday, November 10th, 1909. The Institution dinner will be held in the Great Hall, Armstrong College, Newcastle-upon-Tyne, on Friday evening, December 10th.

NAVAL RESERVE DECORATIONS.—The Secretary of the Admiralty has announced that the restriction on the award of the decoration for officers of the Royal Naval Reserve and Royal Naval Volunteer Reserve to those who were on the active list on Jan. 1, 1908, has been removed. The decoration will accordingly be awarded to all officers, active and retired, who are qualified by length of service, etc., under the regulations. The long service and good conduct medal for men of the Royal Naval Reserve and long service medal for men of the Royal Naval Volunteer Reserve will similarly be awarded to men who satisfy the other condition of award, whether now serving or not.

OBITUARY.

Mr. Peter Samson.—The death of Mr. Peter Samson, I.S.O., at his residence on the 20th September, at the age of sixty-seven, will be heard of with great regret by everyone connected with the shipbuilding and marine engineering industries. Few men were better known in and more intimately associated with everything appertaining to marine engineering progress than the late Mr. Samson up to the time of his retirement from the position of Engineer-Surveyor-in-Chief to the Board of Trade in January of this year. Mr. Samson, who was of Scotch extraction, was born in New Glasgow, Nova Scotia, in 1842, and was apprenticed at the age of fifteen to Messrs. Randolph, Elder & Co., of Glasgow, engine builders. He was for a time with the well-known firm of Messrs. Simons and Co., of Renfrew, and later entered the Royal Navy, serving as Assistant Engineer in H.M.S. *Assurance* and *Northumberland* and retired in 1870 with the rank of engineer. Two years later, when the work of measuring the tonnage of merchant ships was taken over by the Board of Trade, Mr. Samson secured an appointment to that body, as assistant surveyor. He was closely associated with Mr. T. W. Traill, and when the latter retired from the position of Engineer-Surveyor-in-Chief to the Board of Trade in 1896, Mr. Samson was appointed his successor, an acknowledgment of his undoubted ability, which responsible position he retained for thirteen years. Mr. Samson was a member of the Institution of Naval Architects, of the Institution of Engineers and Shipbuilders in Scotland, and of the Committee appointed by the Admiralty in 1892 to investigate the subject of the designs of engines and boilers for the Navy. He was a member of the Committee for the Standardization of Materials for Ships and Boilers and of the Committee of the Privy Council for Trade. In 1907 he had the honour of being made a Companion of the Imperial Service Order.

REVIEWS.

Engine Room Practice. By John G. Liversidge, R.N. 6/- nett. Charles Griffin & Co., Ltd., London.

THIS is the sixth edition of "Engine Room Practice," the fifth edition of which we reviewed in our March issue of 1906. The present edition but serves to show how the demand for Mr. Liversidge's book continues. We find that a number of notes have been added (already extensive in the fifth edition) to more fully embody the practice found suitable for the maintenance of the various types of water-tube boilers now in general use. The footnotes draw attention to recent improvements in the methods used for the maintenance of engines and boilers in steamships, as, for instance, the prevention of grease in boilers. We would again point out that the success of this work is largely due to the method adopted by the author in treating his subject, in that instead of dealing with merely the designs and structure of main engines, he deals chiefly with the mode of procedure in the engine room and the repairs and adjustments of the machinery there found. The general adoption of the micrometer to measure engine adjustments has produced smoother working machinery, and the author has endeavoured to gather and set out the amount of "clearance" which is suitable for the various working parts. With regard to the notes added to the present edition, the particulars of the proceedings of the Hon. C. Parsons in his work with the experimental boat "Turbinia," and its details as to speed, construction of engines, the details of shafts, each with three screw propellers, have been set out. In a further note Sir William White is quoted as to the advantages of twin screws, as compared with triple screws, but subject to the statement by him, that with three shafts and engines, the manufacturing difficulties are less than with two. The details of procedure for either raising steam or for details of attention to engines and boilers are given most completely. In the chapter upon "Preservation and Repairs of Boilers," we find an added note given by Mr. Couper before the Institution of Engineers and Shipbuilders in Scotland as to the internal corrosion of boilers being mainly due to air and carbonic acid gas, dissolved in the feed-water, which is par-

ticularly noticeable in a part of the boiler where the circulation is bad. The notes given on the repair of Belleville and Niclausse boilers are quite up-to-date, and the conditions of service of Engineer Officers and Engineers of the steamship lines are well set out and explained.

Text-Book of Navigation and Nautical Astronomy. By Capt. A. P. W. Williamson, F.R.G.S. (7/6 nett). Messrs. J. Griffin & Co., London and Portsmouth.

THE work under review furnishes a complete and reliable text-book for those who are studying for the Board of Trade Examinations and is also a complete text-book for general students. We are glad to see that all information to suit a beginner is given by very copious definitions, and the method of working out examples has been fully explained, with illustrated diagrams where such are necessary. Board of Trade candidates are given a thorough understanding of all problems that are likely to be set them. It is noticeable that candidates for second mate, first mate and ordinary master are not expected to draw diagrams or to give formulæ, so that the formulæ and explanations referring to diagrams are printed in smaller type, and are marked with a dagger to indicate that these portions may be omitted by those studying for ordinary certificates. Part IV. contains the additional navigation for extra masters, which contains plane trigonometry with all the trigonometrical ratios fully explanied. After the plane trigonometry, spherical trigonometry is introduced and is well written, with the question of double altitudes, a direct method of finding the double altitude being given, with also the double altitude by star. After this, great circle sailing is well expressed, with a compass syllabus; and finally chart construction is explained, with details of construction of a chart on Mercator's projection. Part V. contains the investigation of the problems which should be of interest to those studying for the examination under the Board of Education, as well as to students in general. Finally we find the volume closes with an Appendix, which contains a large series of examination papers and a series of carefully marked answers to all the questions that have been set in the volume. The general tenor of this book is to give clearly to all students the principles that they will have to apply, and all the examples given have been carefully selected and graduated according to the knowledge acquired by the student. They fully comprise all the varieties of questions that the student is likely to meet with, and the work, both as regards theory and practice, merits the success with which it will undoubtedly meet. The elements from the Nautical Almanack necessary for working out all the problems have been inserted at the end of the volume.

Universal Code Economiser. Invented by Sydney A. M. Rose, A.M.I.E.E. 10/6 nett. London Sidgwick and Jackson, Ltd.

IN view of the controversy which rages with unabated intensity on the question of cable charges, it is interesting to note that Messrs. Sidgwick & Jackson, Ltd., have published a new University Code Economiser by Mr. Sydney A. M. Rose, A.M.I.E.E., a copy of which we have received. This work considerably reduces the cost of cablegrams and gives in a marked degree simplicity, accuracy and secrecy. Errors can be detected at sight and instantly rectified, not one of the million of code words made available having a single alternative transposition. We understand that Mr. Rose's book has received the endorsement of the highest authorities, and the new system should meet with a favourable reception from all whose business necessitates telegraphic communication with America or the British dominions over sea.

British Standard Specification for Keys and Keyways (Report No. 46). Published for The Engineering Standards Committee. Price 2/6 nett. London: Crosby Lockwood & Son.

THE Report No. 46 is divided into two sections, the first being a specification for the steel bars from which the keys are to be cut, and the second dealing with the proportions of Keys and Keyways recommended. The specification requires a minimum tensile breaking strength of 36 tons per square inch with an elongation of 12% on the test piece specified. A list of standard sizes is given and the margins of manufacture to be allowed on merchant bar are defined. With regard to the second section of the Report, the information which the Committee obtained from Engine Builders and others was supplemented by the results of their own experimental work, and the Standard Sections for sunk keys given are based on the data obtained from these two sources. The engineering industry should largely benefit from the introduction of the Committee's Standards, though at present only sunk keys (taper and parallel) are dealt with. Recommendations as to tolerances on the finished Key and Keyway are included. The experimental work for the Sub-Committee was carried out by Mr. P. A. Ransom and it is to be hoped that the data obtained during these experiments may at some future date form the subject of a communication to one of the Technical Societies. The information should prove of great interest as it is bound to throw considerable light on a subject on which there is a paucity of experimental data. By the issue of this Report it should become possible to order Standard Steel Bars from the stock of the various rolling mills by merely quoting the designating numbers from the Schedule given in Standard Specification.

BOOKS RECEIVED.

A Manual of Elementary Seamanship. By Comm. D. Wilson Barker, R.N.R., etc. Price 6/-. London: Charles Griffin & Co.

The Mechanical World Pocket Diary and Year Book for 1910. Price 6d. Manchester: Emmott and Co., Ltd.

Applied Mechanics. A Text-book for Engineering Students, by David Allan Low, Wh.Sc., M.I.M.E., etc. Price 7/6 nett. London: Longmans, Green & Co.

ELECTRICAL NOTES.

Radio Telegraphy.

A PAPER has recently been read at Newcastle, ostensibly on the Cullercoats station, but it deals generally with the subject, and in view of the considerable developments taking place in this direction some description of the paper may not be out of place. The author prefaces his remarks with a little that is historical, in which he notes the stages that this branch of electrical science has passed through. He shows how electrical oscillations and magnetic waves are formed. The Hertz oscillator consists of two metal rods with metal balls at one end and placed near together to form a spark gap between them, metal plates being fixed to the rods at the other end to form a condenser. The spark balls are connected to the secondary of an induction coil from which the condenser is charged, and when a certain potential is reached discharge takes place through the spark gap. With the circuit thus completed oscillations are set up and waves radiated. By means of similar circuits Hertz succeeded in detecting waves at a distance from the apparatus, the radiation being made more powerful by using long antennæ on one side of the spark gap and connecting the other to earth. For detecting the oscillations the coherer was discovered, and with the introduction of the telegraphic key in the primary of the inductorium, and connecting the coherer in the receiver to a Morse inker, the impulses sent out and received were controlled and Morse code signals established radio-telegraphic communication. The oscillations would die out rapidly, the energy being dissipated by the radiation, if the oscillations were not damped and comparatively long inactive intervals made to follow each train of waves and to obtain the maximum effect of oscillations in one circuit on another, the two circuits have to be in electrical resonance or tuned to the same frequency. The tuning depends on the damping, the smaller the damping the sharper the tuning. This principle is the same in all systems, there being only a difference in detail, chiefly in the receiver, various forms of detectors being employed. In the case under notice the town's supply of 480 volts is used to work a motor generator the speed of which can be regulated by field resistance from 1,800 to

2,400 revolutions per minute, but the general description of principles is likely to be of more interest than figures of this particular installation.

Iron Corrosion.

The electrolytic theory of iron corrosion has been the subject of a paper read at the Iron and Steel Institute and the information furnished is of a very valuable character. We endeavour to cull some of the leading points. Metals are said to vary in the rate they dissolve when in contact with water from sodium or potassium at one end, which dissolve instantly, to platinum and gold where such a tendency is zero. An atom of metal passes into the water, a positive charge of electricity is set up leaving the mass charged negatively. The metal and solution being of opposite polarity the solvent action soon ceases, and if there be in the water another metal of a smaller solution pressure the first action will be reversed and the iron with the less solution pressure will pass back to the metallic state, plating out on the first metal and giving out its charge of electricity, the first metal being charged positively and the solution near negatively. This reversal in the end has the effect of destroying the electrolytic layers, and solvent action of the water on the first metal continues, as instanced in the well-known Daniell cell. Without being able to go fully into the conclusions enumerated of the theory one may be noted. If iron and zinc be in water with a little salt the iron will corrode and the zinc be protected, but if the two are connected instead of separated the iron will no longer corrode; the zinc that was before saved by the electrolytic double layer is no longer so and zinc ions are now forced into solution, the zinc becoming the anode and the iron the cathode, the hydrogen set free by the solution of the zinc finding a surface in the iron to protect it. This is an important point and worthy of note.

Statistics of group-driven tools.

This question always commands attention, and particulars are published showing what is possible on a new installation throughout, the shafting being 180 ft. long and the motor at one end connected to it by belting. The power of this machine is 30 h.p. at 600 revs., 220 volts, and taking 112 ampères direct current with 24 machines coupled to the shaft. About half the machines are usually doing work at one time and every care was apparently used in the tests, with the following results: To start machines from rest required about 31,000 watts; to run shafting light, nearly 8,000 watts; all machines without cutting, 11,000 watts; and with cut on 12,000 watts. Under normal working conditions about 10,000 watts were expended, and the loss at the motor about 1,600 watts, while to remove the metal under ordinary working conditions took over 400 watts. The range of tools on the line of shafting comprised slotters, millers and shapers.

THE SUBMARINE SIGNAL COMPANY state that the Trinity House recently issued a notice to mariners stating that their electric signal bell off the North Stack, Holyhead, is now in position. A further notice states that one of their bell buoys is to be placed in the neighbourhood of the Wolf Rock Lighthouse, near Land's End.

A VIKING PONTOON BRIDGE: UNIQUE RELIC.—An excellent model of the Viking pontoon bridge or raft found near Brigg some years ago, together with one of the cleats of the old structure, has been placed in the Lincoln Museum by the City Sheriff. The original bridge was unearthed on Lord Yarborough's land about three feet from the surface, and not far from the spot where an old British "dug-out" boat was discovered two years earlier. It was 40 ft. long and 9 ft. wide at its widest part, tapering off at one end to 5½ ft. Built of oak trees split down the middle, with ten cleats to each plank cut out of the solid and held together by rods, it must have been a massive structure. The tie bars were secured by wedges driven in at each end of the bar, and also by a wedge driven in along the middle row of cleats, apparently to keep the pontoon tight. The joints were caulked with moss, and covered with straight pieces of wood like the halves of young sapling trees, and these were fastened down over each joint by lacings or lashings of hide. The bridge was made to rise and fall with the tide, and is the only one of its kind ever found in England. It is believed to have been used by the Danes when they invaded North Lincolnshire in the tenth century.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Industrial Situation.—Apart from the large amount of naval work under construction on the Clyde—and ere these notes come under the eyes of readers the amount will in all likelihood be greatly augmented—shipbuilding for ordinary mercantile purposes has begun to show a welcome improvement. This is shown, not only by the substantial orders for cargo carriers already placed or daily expected, but by Lloyd's returns for the third quarter of the current year. The mercantile work on hand in the lower reaches of the river as at end of September was about 37,000 tons better than the corresponding period of last year but 10,500 tons less than the total for the quarter ending with June. The Admiralty work in the lower reaches—which includes the battleship *Colossus*, building by the Scott Co.—is not taken into account in these figures, so that in reality there is an improvement in the amount of work on hand. In the upper reaches of the river there is an advance of 19,500 tons, compared with a year ago, while the work on hand is nearly 32,000 tons better than at the end of the second quarter. The outstanding feature, however, of the industrial situation is the unusually large number of naval ships under construction, and the high hopes entertained at the moment of writing that the vloume of such work will be largely added to, definitely, within a short time. Although the number of naval ships actually on the docks was reduced on the 6th October by the launch at Fairfield of H.M.S. *Glasgow*, the first of the five second-class cruisers placed in November last; by the launch from Messrs. John Brown & Co. on October 17th of the torpedo destroyer *Beagle*, the first of the sixteen destroyers of the 1908-9 programme to be put into the water; and by the launch, on October 28th, of the second-class cruiser *Gloucester* from the stocks of Messrs. Wm. Beardmore & Co., Dalmuir, there are still left the battleship *Colossus* at Greenock, the cruiser *Bristol* at Clydebank, and no fewer than nineteen torpedo-boat destroyers, including the nine placed during September—three with the Fairfield Co., Govan, three with Messrs. John Brown and Co., Clydebank, two with Messrs. W. Denny & Brothers, Dumbarton and one with Messrs. A. & J. Inglis, Pointhouse.

Notable Launches.—Besides the important naval ships above referred to, the month of October saw the consignment to their native element of a number of large liners and cargo-carrying steamers, although in this respect the previous month's output was even more notable, when as many as eight screw steamers, each considerably over 4300 tons, and aggregating 36,770 tons, were launched. In respect of tonnage, and character of outfit as well perhaps, the most important addition to our mercantile navy in October was the *Grantully Castle* of about 8000 tons, launched by Messrs. Barclay, Curle & Co., Whiteinch, for the Union Castle Line. On the same day Scott's Shipbuilding and Engineering Co., Greenock, launched a high-class passenger steamer to have high speed for the Grangemouth and London service of the Carron Company. Early in the month Messrs. Napier and Miller, Ltd., Old Kilpatrick launched the *Norman Monarch*, a steamer of 5000 tons gross for the Monarch Fleet, managed by Messrs. Raeburn & Vérel, Glasgow.

Messrs. William Hamilton & Co., Port Glasgow, launched on October 18th the steel-screw steamer *Mercurius* of about 4500 tons, which is the first of three this firm have on hand for the Koninklyke Nederlandsche Stoomboot Maatschappij, Amsterdam. The three vessels are being built on the Isherwood longitudinal frame principle, as are the whole of the vessels now on Messrs. Hamilton & Co.'s stocks.

Contracts: Prospective and Actual.—The five or six firms on the Clyde who sent in tenders for the four *Bristol* cruisers, as also later for the four "contingent" battleships, still to be given out, await the decision of the Lords of the Admiralty with considerable confidence that due measure of the fresh work will find its way to Clyde stocks. Of mercantile work reported as forthcoming, or already placed, some mention should be made. Five meat-carrying steamers are said to have been placed "provisionally" with firms in

Port Glasgow and Greenock, the tonnage of the lot aggregating between 40,000 and 50,000 tons. The Trieste firm of Cosulich, who during the past two years have largely patronized Clyde builders, are reported to be about to place an order for an improved *Martha Washington*, which was built last year by Messrs. Russell & Co., Port Glasgow. A Swedish shipping concern, for which builders in the upper reaches have built largely, are likely to place orders for two steamers of considerable size for passenger and cargo service. Following are the orders known to be actually placed since last month's notes were penned.

Messrs. Archibald McMillan & Son, Dumbarton, have received an order from Messrs. McBeth & Co., Glasgow, for a steamer of fully 8000 tons carrying capacity. Engines and boilers will be supplied by a marine engineering firm in Glasgow

Messrs. John Brown & Co., Clydebank, have received the order—through the designers, Messrs. G. L. Watson & Co., Glasgow—to build and engine a luxuriously fitted steam yacht of about 1000 tons, the owner being Mr. S. B. Joel, owner of the steam yacht *Doris*

The Clyde Shipbuilding and Engineering Co., Port Glasgow, have contracted to build and engine for Canadian owners a passenger and cargo steamer of goodly dimensions. Early in October the firm launched a steamer of 235 ft. length for Messrs. T. P. R. Richards, Turpin & Co., Swansea.

Messrs Caird & Co.—The large shipyard of this well-known Greenock firm has been inoperative for a time through want of contracts, but there are now indications of a resumption of activity. The firm are believed to have received the order for a large steamer of the high-class character for which they have long been renowned. The foundry of the firm has been reopened and a number of workmen started. Some little time ago the firm received the contract from a Trieste Company to supply a number of large boilers, work on which is now proceeding.

The Ailsa Shipbuilding Co., of Troon and Ayr, have booked an order for a twin-screw steamer for the Mersey ferry work of the Birkenhead Corporation. The vessel, which will be 150 ft. in length, will be built in the Company's Ayr yard. The Company have recently completed and handed over, after satisfactory speed trials, the twin-screw passenger and cargo steamer *Merimbula*, built to the order of the Illawarra and South Coast Steam Navigation Co., Ltd., N.S.W.

Messrs. John Cran & Co., Leith, have received from Trinity House a contract for two pilot yawls, each 68 ft. in length. The two vessels will be propelled by motor power.

Messrs. Hawthorns & Co., Leith, have received from Messrs. C. Salvesen & Co., Leith, an order for three whaling craft for use in connection with that firm's northern whaling stations. The vessels, which will be 90 ft. long, will be constructed of steel and are expected to be completed about the month of March next.

Coventry Ordnance Co.—The extensive workshops and loading and discharging basin of the Coventry Ordnance Co. on the Clyde, at Scotstoun—which have been erected for some time but inoperative so far—are now being completed for an early start on ordnance work. The Coventry Ordnance Co., as is now well known, have received a substantial order from the Admiralty for armament intended for one of the four "contingent Dreadnoughts." It has been stated, indeed, that altogether the Ordnance Co. have received from the British and other governments—Spain and Japan—orders for about £1,000,000 worth of guns and gun-mounting and that, in consequence, about 1500 extra men are about to be engaged. Advertisements emanating from Coventry have of late been appearing in Glasgow newspapers for workmen accustomed to building and erecting large gun mountings. The men are required "for work on the Clyde," and none but those holding similar positions need apply.

Interesting Repair Work.—Messrs. D. & W. Henderson, of Meadowside Yard, Partick, have lately been engaged repairing, in dry dock, the steamer *Tenasserim*, of Messrs. P. Henderson & Co.'s fleet, which was seriously damaged through collision in the Mersey. The nature of the work is described in another column.

Scottish National Exhibition, Glasgow, 1911.—The project of organizing and bringing into being, in 1911, a "Scottish Exhibition of National History, Art and Industry" to be held in Kelvingrove Park, on the same site as that of the highly successful International Exhibition of 1901, is rapidly materializing. The guarantee fund now exceeds £70,000, although the maximum aimed at by the projectors, as ample for all requirements, was only £40,000. The object mainly is to aid, and bring to completion, the fund being raised for the endowment of a chair of Scottish History and Literature in Glasgow University, but the Exhibition cannot fail to be of deep interest to all concerned with Scotland as it is, industrially as well as intellectually. The Executive Council are considering at present a scheme of exhibits which takes account of the following:—A collection of exhibits showing the varied nature of Scotland's industries and of those carried on by Scotsmen in the colonies and abroad; in many industries a contrast made between the old and the new; an electricity exhibit dedicated to the memory of Lord Kelvin; a shipbuilding and marine engineering exhibit of a historical nature showing the development of steam navigation in its home on the Clyde. The river Kelvin, it is proposed, should be taken advantage of to represent historic episodes in Scottish life and industry, and the colonies, so largely peopled from Scotland, are to be invited to tell of the progress of "the Scot abroad." The Exhibition project has a large number of titled patrons, the Marquis of Tullibardine being hon. president, Lord Provost (Mr. J. McInnes Shaw), hon. chairman of executive, Mr. Andrew H. Pettigrew, chairman of executive, and Mr. D. D. Binnie, secretary.

THE TYNE AND WEAR.

(From our Own Correspondent.)

GENERALLY speaking, shipbuilding has not made much improvement. A number of enquiries for ships for special trades are being made, but very few orders are being placed for tramp cargo boats. Many shipbuilders have very little work in hand, others are only moderately busy.

Messrs. Swan, Hunter & Wigham Richardson, Ltd., Wallsend, have recently despatched the s.s. *Salvador*, built to the order of the Salvador Railway Co. Her length is 225 ft., 33 ft. 6 in. beam, with a clipper bow. She has more the appearance of a yacht than an ordinary merchant vessel. A record was created in completing her in sixty-four working days. The company are busy with the framing of a fine passenger vessel for the Compagnie Générale Transatlantique of Paris, and they have laid the keel of the Cunard Co.'s new liner for their Boston service. A floating dock for colonial service and H.M.S. *Hope*—a torpedo boat destroyer—are being proceeded with. Therefore the outlook during the winter months for this company is encouraging.

The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, have been very busy and recently launched three large vessels of between 7000 and 9000 tons, and delivered two of the same size. In September they launched the s.s. *Gerania*, a vessel of over 8000 tons for Mr. D. Tripcovich, of Trieste, the large Furness liner *Parisiana*, a vessel of about 9000 tons deadweight, and the s.s. *Netherpark*, a 7500-ton steamer for Messrs. John Greenlees & Co., Glasgow. Also in September they delivered to Messrs. Thos. Dunlop & Sons of Glasgow, the s.s. *Queen Eugenie*, a fine 7500-ton steamer, and completed the Furness liner *Feliciana*, a 7400-ton deadweight steamer. This turn-out probably constitutes a record for any firm for one month, and it is interesting to know that the berths left vacant by the above-mentioned launches have been filled with keels for other vessels. We understand that the Northumberland Shipbuilding Co., Ltd., has work to keep it fully occupied during the whole of the coming winter.

Messrs. S. P. Austin & Son, Ltd., Sunderland, launched a small steamer during the month for the Marquis of Londonderry's coal trade and the vacated berth will be immediately occupied by a vessel of somewhat larger dimensions. Another vessel will shortly be ready for launching and the work to the vessel on the builder's third berth is being pushed forward. The Hull steamer *Corinthic* is on the pontoon for large damage repairs to bottom, sheet plating, floors, etc., in consequence of stranding, and there is also repairing work being carried out by the Company in their graving dock and afloat.

Early in October a number of big steamers were in the

Tyne for dry docking, etc. Among them being the *Norseman*, the Dominion Liner *Irishman*, the Shaw-Savill liner *Matatua*, and some vessels belonging to the Atlantic Transport Line.

THE TEES AND HARTLEPOOLS.

(*From our Own Correspondent.*)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, have secured a contract to build two large single-deck cargo boats, also two steamers, for Messrs. Furness, Withy & Co. Messrs. W. Harkess & Co. are reported to have secured two contracts during the month. Trade at this port is now better than at any time during this year.

Messrs. Richardsons, Westgarth & Co. have secured the contract to build the engine and boilers for the two cargo steamers to be built by Messrs. Sir Raylton Dixon & Co., previously mentioned, and which are to replace the two large cargo boats recently sold by Messrs. Furness, Withy and Co., to German owners, reported to be the Hamburg-Amerika Line.

Stockton and Thornaby.

Messrs. Robert Ropner & Sons are reported to have secured the contract to build a large cargo boat of 6300 tons deadweight on 21 ft. 5 in. for Messrs. W. R. Smith & Sons, of Cardiff, the price being about £33,300. The machinery will be supplied by Messrs. The North-Eastern Marine Engineering Co., Sunderland, the cylinders being 24 in., 40 in., 66 in. diameter by 45 in. stroke, of about 1400 I.H.P.; delivery to be either the end of February or early in March.

Messrs. Craig, Taylor & Co. are now very busy and have during the month secured contracts to build four cargo vessels of medium size. Messrs. Blair & Co. are reported to have secured contracts to build six sets of engines for vessels building on the Tees, and are now fairly busy. It was expected locally that the contracts placed by The International Line Steamship Co. and Messrs. Rowland & Marwood Steamship Co., Whitby, would have come to this port, but they have been placed with the Tyne Iron Shipbuilding Co., Willington Quay-on-Tyne, with machinery by Messrs. J. Dickinson, Sunderland.

West Hartlepool.

Messrs. W. Gray & Co. have secured two contracts, one a large cargo boat of 9000 tons deadweight for Messrs. Tonlinksen, of Bergen, the machinery for which will be supplied by their Central Marine Engine Works. Messrs. J. & R. O. Sanderson, of West Hartlepool and Cardiff, have also recently placed an order with Messrs. W. Gray & Co. for a large cargo steamer, which will be of about 6,200 tons deadweight, and is intended for the Black Sea, Indian and American Plate trades. The machinery will be supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., to give her a sea speed of 9 knots. This firm is somewhat busier, but not to the extent it should be.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Harbour Yard, have launched two steamers during the month and are well on with two more steamers; they have been busy with repair work, and have just secured the contract to repair the steamship *Jessie*, belonging to Messrs. C. Nielson & Son, which has been ashore; the contract will mean an expenditure of about £9000.

Hartlepool.

Messrs. Irvine's Shipbuilding Co., Ltd., Middleton Yard, have secured the contract to build two large cargo boats for Messrs. Furness, Withy & Co., for delivery about next April. They have also been busy with repair work and now have the steamships *Dahome*, *Pontos* and s.s. *Palagos* on hand.

Messrs. Richardsons, Westgarth & Co. have secured the contract to supply the machinery for the two new steamers to be built by Messrs. Irvine & Co., Middleton, the engines of the triple-expansion type will indicate about 1800 H.P. and will have the contraflo type of condenser, now universal with this firm, and which is giving very satisfactory result. This firm has also secured another large condensing plant installation and is kept busy in this department, also with their various specialities.

THE HUMBER AND DISTRICT.

(*From our Own Correspondent.*)

With much regret we have to report the death of Alderman W. A. Massey, J.P., Shipowner, and Consular Agent for Belgium. Only a few weeks ago the King of the Belgians conferred upon him the honour of Knighthood (Chevalier de L'Ordre de Leopold). He was Sheriff of Hull, and Chairman of Parliamentary and other Committees, and took very great interest in the work of the city. As Chairman of the Humber Pilotage Board, his advice on matters was rarely challenged by his colleagues; he also had a seat on the Directorate representing the City on the Hull and Barnsley Railway and Dock Company. Public recognition of the great services rendered to the City by the late Alderman Massey was made in October, 1906, when his twenty-six years' membership of the Corporation was marked by a presentation at the Town Hall. The Presentation took the form of a handsome Silver-gilt Casket, a Silver Flower Service, and a Diamond Pendant, the design of Casket being emblematical of the incidents of his career. The Corporation has lost one of its ablest members. The funeral took place at Brantingthrope, close to Hull, and was attended by the Mayor, Alderman Feldman, J.P., and the members of the City Council, and among many others, officials of the R.M.S.P. Co. of Southampton, Alderman Massey, J.P., being agent for this Company in Hull and district.

We also have to record the death of John Wark Blakeney, who has been resident in Hull for over forty years. He was by calling a compass adjuster and maker, and was well known on the Clyde in the sixties. He had travelled all round the coast in pursuit of his business and knew every shipping firm in the world of any importance. He was one of the foremost men in his trade and had a great depth of knowledge of his subject. He was born in Glasgow—seventy-two years ago—and educated for the Ministry of the Presbyterian Church. Upon the death of an uncle he took part in the business, enjoyed great success, and eventually became financially interested in shipping. He gave freely to charities and passed away a comparatively poor man. He was held in the greatest respect and was a personal friend of the late Lord Nunburnholme. His father was Captain of the first steamboat to run between Troon and Arran on the Clyde.

North-East Coast Engineering Works, Hull, are new works recently opened, situated in Wyke Street, Hedon Road, and one minute from the gates of Alexandra Dock. The partners are Edward and John Clarke, both practical marine engineers. Mr. E. Clarke has had a very large and useful engineering and dry dock experience, and was formerly outside foreman engineer for the Central Dry Dock Co., Ltd. for a number of years. The establishment is fitted up with all up-to-date machinery, driven by electricity from the Corporation mains and owners of steamers can rely on quick dispatch. The works are well arranged and we wish the Brothers Clarke success in their undertaking.

Messrs. Cooper & Co., engineers and boilermakers, Hull, are having a fair share of docking and repair work; the branch shop at the Alexandra Dock seems to have a number of men employed, but is still able to cope with more work.

Central Dry Dock and Engineering Co., Ltd., have been fairly kept at work, using their own dry dock and the dry docks of H.B.Ry. Co. and N.E.Ry. Co. docks. They have had the ss. *Cherrybrook* at the Alexandra Dry Dock, receiving new stem, rudder and propeller, and other general repairs; the ss. *Waverley* for a few new plates in bottom, and engine and deck repairs; also ss. *Windermere*, ss. *Cayo Manzillo* and other steamers for repair. The firm is fortunate in generally securing orders for dock repairs.

Messrs. Amos & Smith, engineers and boilermakers, seem to be lacking fresh orders for engines and boilers, but are securing repair work.

Messrs. Gemmell & Frow, engineers and ironfounders, are keeping fairly busy, but lack fresh orders.

Messrs. Stewart & Craig, engineers and ship repairers, are fairly busy. They have finished the ss. *Meta* and ss. *Normandie*, several plates in bows and frames of each and engine and deck repairs, slowly going on with repair work.

Earle's Shipbuilding and Engineering Co., Ltd., have received an order from the Wilson Line for a new steamer for the

Norwegian passenger service, a similar ship to their R.M.S. *Aaro* built by this Company a few months ago. They have on hand constructing a 250-feet steamer for a London firm. The lightship for the Humber Conservancy is nearing completion. The steamer *Dago* is making satisfactory progress. This steamer was ashore some time in the Gulf of Riga, Baltic. The company have a fair amount of repair work in hand. The prospects for the winter are bright.

Messrs. Cook, Welton & Gemmell, Ltd., Beverley, have nothing particular on hand beyond that on the 2nd inst. they launched a steam trawler for Thos. Bascomb, Esq., of Grimsby. Name, *Seriema*; Dimensions: length, 135 ft.; breadth, 22 ft. 9 in.; moulded depth, 12 ft. 7 in. A sister vessel *Martineta* was launched on the 16th inst. Business is very quiet; no fresh orders.

Humber Iron Works, Hull.—This firm has been rather busy during this last month in docking and slipping of steamers, and general repair work. Enquiries for new work are more frequent, these being specially welcome, as they are just completing a set of marine engines (triple) 1700 I.H.P.

THAMES.

(From our Own Correspondent.)

Naval Contracts.—As the specifications are in preparation for more "Dreadnoughts," it is opportune to consider the chances that London has for securing the building of one of them, and a stage has been advanced by the interview which Mr. Straus and Sir John Bethell, with other Liberal members, have had with the First Lord of the Admiralty. It is now certain that the Thames Shipbuilding Co. will be invited to tender for one of the vessels, but there are difficulties to be overcome. A "Dreadnought" cannot be built in the docks owing to the width of the ship being 85 ft., and completion could not take place in the narrow waterway of the river with the traffic. As a solution of the matter it has been agreed to take the craft, if an order is given, five miles down the river to Dagenham, where the breadth of channel is 1500 ft. and where the work, it is thought, might be continued safely. The risk, if any, would be on the contractors. No doubt every effort is being made to secure that some of the money to be spent should come to London, with what result we shall not have to wait long now to know.

Port of London.—The question of the dues to be levied on goods by the new Act and to which we have previously referred, has been the subject of a question in the House of Commons. In this question to the Board of Trade it was suggested that the revenue derivable would be a million and a quarter pounds, or three times the sum authorized, on a maximum, and ten times the figure the Board of Trade gave before the passing of the Act. The answer given in Parliament was that the authority had not officially put forward any statement of a proposed levy, and that when they did it was subject to agreement by the Board of Trade after an enquiry at which all parties interested would be heard. It seems clear that there is a wide margin between the estimates put forward when the Bill was going through, and what is now thrown out when the authority is in full existence and trade must suffer in the port if expenses are to go up under the new *régime*. This is the direct cause of the Thames suffering so much now compared with other ports.

Thames Steamers.—The City Steamship Co. has completed the purchase of the fourteen boats contracted for by the L.C.C. in 1906 for £6500 each, and now bought for the low figure of £715 each. When this issue appears a partial service will probably have been initiated, the chairman having stated that boats would run on the 21st ult. between London Bridge and Cherry Garden Pier, the full service being left for the coming spring.

The Watermen's Dispute.—The dispute between the Thames watermen and the master lightermen and barge owners has been ended. The apprentices, 250 in number, went on strike on July 3rd and the Board of Trade intervening appointed an arbitrator who had to determine if the apprentices could be called on for more than a twelve-hour day, and the point has been decided in favour of the apprentices and the termination has thus prevented what might have ended more seriously for the trade of the port.

Ocean Training.—The *Port Jackson* has left the Thames again for Sydney with thirty-seven midshipmen aboard out of a crew of seventy-five. The system inaugurated in 1890 by Lord Brassey, in conjunction with Messrs. Derritt & Moore, has been most successful and many officers have been trained in this way. The vessel, a four-masted barque, carries a general cargo and is of 2300 tons. It is expected she will reach Sydney before Christmas, all being well.

The "Nimrod."—The bringing of the *Nimrod* up the river, opposite the Temple, has been successful in every way. The Lord Mayor and Sheriffs have paid an official visit, and in opening the exhibition of relics made a most eulogistic speech. To take one day alone, the vessel was visited by 2986 persons, and the takings were £72, the amount on this occasion going to the Poplar Hospital. The success achieved must help to aid the already projected expedition to follow under Capt. Scott, a former commander.

Yacht Racing Association.—This body has held a meeting at the Royal Thames Yacht Club, the success of the past season leading up to the question of next year's fixtures. On the matter of a racing dispute between *Shamrock* and *White Heather*, the decision of the Royal Cinque Ports Club was reversed by the Association, and *Shamrock* now leads by this decision.

SOUTHAMPTON.

(From our own Correspondent.)

The R.M.S.P. Co. have disposed of the steamer *Orinoco* to the Forth Shipbreaking Co., Bo'ness. This vessel was built and engined by Messrs. Caird & Co. in 1886, and has been in the R.M.S.P. Co.'s West Indian service for a number of years. The *Orinoco* was a particularly fine modelled steamer, and the model was awarded a prize at the Naval Exhibition shortly after the vessel commenced running. She is of the following dimensions:—Length, 400·7 ft.; beam, 45 ft.; and depth, 25·4 ft., with a gross tonnage of 4,572 tons and a nett tonnage of 2,451 tons. Her position on the West Indian Service has been taken by the R.M.S.P. *Oruba*, which was purchased by the Company when they ran to Australia in connection with the Orient Co.

The Union Castle Co.—The first of the four steamers building for this Company was launched last month, and it is anticipated that before the end of the year the other three vessels will also be in the water, so that they should be ready for service in the early part of next year. Two of these vessels are intended for the Company's Cape Mail Service and the other two for the intermediate service. The mail steamers are to be named the *Balmoral* and *Edinburgh Castles* respectively, whilst the vessel launched last month has been christened the *Grantully Castle*. The sister intermediate vessel will be named *Garth Castle*.

Messrs. Day, Summers & Co., Northam Ironworks, are well advanced with the construction of the powerful twin-screw tug boat which they are building to the order of the Isle of Wight and South of England Steam Packet Co. The vessel was in frame last month and the shell plating is now well advanced. In the engine department most of the heavy forgings and castings are completed, also the boilers are well advanced. Several other vessels belonging to this Company have been at the yard undergoing repair. Extensive boiler repairs have been completed to the tug *Hercules*, and she left the yard last month. The Company's ps. *Lorna Doone* was on the slip undergoing repairs to her sponsons and has now taken up her mud berth for the winter. Also the tug *Albert Edward* was on the slip last month undergoing survey.

Messrs. J. I. Thornycroft & Co., Ltd.—H.M.S. *Savage*. Good progress is being made with the work on this vessel and the main and auxiliary engine seatings were completed last month, also the machinery is well advanced. The four destroyers which the firm are building for the British Admiralty have been allotted the following names *Lyne*, *Lyra*, *Martin*, and *Minstrel*. Last April a steam tug and passenger flat were shipped to China, and these have now been re erected at Shanghai, and gone through their steam trials, which have been very successful. The striking appearance of the boats has given rise to much favourable comment in the Chinese

press. Work has been commenced on the shallow-draught tug boat for Russia. This vessel is 140 feet long and is driven by side paddle wheels. Mine-laying and torpedo base vessel for Portugal. Good progress has been made with this vessel which is now plated. Four ferry steamers for Calcutta. These vessels have been erected and dismantled, and will be shipped this month. The Company have received orders for a 40-feet and a 24-feet motor launch. The hulls of these launches will be constructed at the Woolston works, and the motors at the Company's works at Basingstoke. They have also been busy with repair work and alterations to the following troopships—*Soudan, Plassy, Rohilla, Rewa, Dongola* and *Braemar Castle.*

Messrs. Summers & Payne, Ltd., Northam.—Mr. Jas. Ross's *Sheelah* has arrived at the yard from Canada, and taken up her accustomed berth, where she will be dismantled. *Iolaire*, 17 tons cutter recently purchased by Mr. H. R. Tweedy, of Dublin, has had ballast taken out and is dismantled and was hauled up last month. Work is proceeding on *Invincible*, 451 tons auxiliary screw schooner (Hon. H. G. Squiers), including re-serving rigging, cementing outside, etc. *Iolanda*, 1,827 tons, Mr. Morton F. Plant, arrived last month and was docked and sundry alterations are now in hand. *Javelin*, 53-tons ketch, Monsieur Ph. de Vilmorin, is now undergoing reclassification for a further period by Lloyd's and is being renovated as required. Four 30-feet cutters have now been delivered to the Admiralty and a fifth is nearing completion. The lead keel has been run and the wood keel cut out for a 12-metre L.R. on order for a Russian yachtsman.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Vickers' Record Order.—Naturally there is a considerable amount of satisfaction in the town on account of the order Messrs. Vickers, Sons & Maxim have booked. Turbine machinery for the new improved "Dreadnought" cruiser to be built at Devonport of 70,000 i.h.p. is a record for the world. The competition for this important order was very keen to say the least, and it is a feather in the cap of this firm who have in the past been most successful in the construction of high-power engines and turbines. It will be remembered that they were the constructors of the turbines of the *Dreadnought*, which were most successful. It, of course, requires official confirmation, but at the same time it can be taken as a fact that the Barrow company have booked the order. This order means that turbines of 4000 more i.h.p. than the *Mauretania* have to be constructed, and that if all reports be true a speed of something like 30 knots is aimed at. When one comes to think of such power and place it against previous vessels of this class, such as the *Invincible*, with 45,000 i.h.p., or the *Vanguard*, with 25,000, one realizes the enormous jump the Admiralty designers are taking, and further can realize to some extent the size of vessel that is to be constructed. It will probably carry eight large guns each capable of being fired on either broadside. The tonnage will be much greater, naturally. The work is to be put in hand very soon, and Messrs. Vickers will construct everything at Barrow in connection with the turbines. Sections of the boilers—Babcock and Wilcock—will, of course, be supplied. Messrs. Vickers are tendering for a Cunarder of 23 knots to take the place of the ill-fated *Lucania*.

H.M.S. "Liverpool."—This second-class cruiser came off the stocks on the 30th of last month (October). The turbines for this vessel are very nearly ready, and Messrs. Vickers will not be long in turning out this vessel. The work is well forward; as she will lie at the Devonshire Dock Wharf, there will be no delay in fitting her out. This vessel is said to have a speed of 25 knots, but I shall not be surprised to learn that she can do more.

Four vessels of the *Liverpool* class are about to be ordered, and the tenders have been in for some time. It is stated that Messrs. Vickers were the lowest in price, and that they were followed by Messrs. Armstrong and Messrs. Beardmore. As to where the fourth will go it is not known yet, and this may be the means of keeping the orders back for a time. It is almost certain that Messrs. Vickers will get one unless the Admiralty have something better for them.

The "Vanguard."—The battleship *Vanguard* at the time of writing is almost ready for her trials. According to present arrangements this ship will leave Barrow on or about the 28th of October, and will proceed to the Mersey, where she will be docked for inspection, painting, etc. After that she will proceed to take her speed trials. It is expected that she will be away about a month, when she will return to Barrow to complete. She will be delivered about the beginning of next March, which will be according to contract. Great headway has been made with the guns and mountings, and in fact to outward appearances she looks almost finished. A speed of 21 knots is required, but it is more likely to be 22.

The "Minas Geraes" Trials.—Messrs. Vickers, Sons and Maxim were the builders of the reciprocating engines and Babcock and Wilcock boilers for this Brazilian battleship, which was built at Elswick, and during the last month she has undergone her full steam trials. These have been most satisfactory, and over 21 knots were obtained with a very satisfactory coal consumption. The data of these trials are not yet to hand, but they will be interesting reading.

The "Sao Paulo."—All the machinery has been put into the sister ship to the *Minas Geraes*, which is building at Barrow, and as soon as the *Vanguard* vacates the inner berth she will commence to take on her guns, funnels and other heavy weights.

The "Contingents."—To the surprise of many the tenders for the two "Dreadnoughts" and cruisers have been asked for, and they have to be in by the 5th of November. Each firm is tendering for both. Messrs. Vickers, of course, are busy with their tender, and it is confidently expected that Barrow will get an order. The new "Dreadnoughts" are to be some 5000 tons heavier than the *Neptune*. They will be longer, will probably have about a speed of 23 knots and will carry 13·5 in. guns. These guns—ten on each ship, mounted in pairs—will be so placed as to allow all to be used on their broadside. This will mean a general re-arrangement. It is more than likely that the second funnel will be placed abaft the third pair and that the fourth and fifth pair will be mounted on the centre line similar to those on the Brazilians, that is, the fourth firing over the fifth. The two cruisers will be similar to the Devonport vessel with 70,000 i.h.p.

Brazilian Floating Dock.—The work on the Brazilian floating dock is proceeding apace and already many plates and bars are in position. It is not known yet how it will be towed out, but very likely it will be in three sections.

Hæmatites.—The hæmatite iron and steel trade is about the same. There has been a slight falling off in prices of warrants, but it was only momentarily and confidence seems to be restored. Consumers would like to place many orders, but owing to a fear that the prices will rise sellers are not anxious to book at present. Makers are asking 63s. for ordinary mixed numbers and warrants are at about 62s. per ton nett cash. Steel makers are only moderately employed. The mills at Barrow and Workington are still engaged upon rails, which are selling at about £5 5s. (heavy sections).

Shipping.—Shipping has improved generally. In iron and steel exports there is a better show of tonnage and the aggregate shipments to date this year are over 100,000 tons in advance of the corresponding period of last year.

At present a Midland Railway Company dredger is undergoing extensive repairs, also other vessels connected with this company's port of Heysham.

The Isle of Man Steam Packet Co.'s vessels, *Ben-my-Chree, Viking, Empress Queen, Prince of Wales* and *Queen Victoria* are now in their winter quarters and undergoing their annual overhaul.

The Furness Railway are on the look out for a passenger vessel for their Barrow-Fleetwood service. They have not yet decided whether to build or purchase a good second-hand vessel. A large number of suitable vessels are being discussed, but latest reports have it that a new vessel is to be ordered on the Clyde similar to the *Barry*, which was built in 1907 to the order of the Barry Railway Co.

BELFAST.

(From our Own Correspondent.)

Tonnage Under Construction.—The fact that Belfast, according to Lloyd's quarterly return, with only two shipbuilding firms, heads the list for the quarter ended 30th

September, is a striking commentary on the deplorable condition of the shipbuilding trade in other centres over the country. 176,530 tons is a high aggregate for nineteen vessels, but this is, of course, accounted for by the enormous tonnage of the two big White Star boats.

Messrs. Harland & Wolff.—Paragraphs have been going the rounds of the daily papers announcing, with more or less certainty, that this eminent firm is about to open a branch establishment in Canada. Much of this is obviously "penny a lining," but considering the large amount of damage to shipping constantly arising from the difficult navigation of the Saint Lawrence, the expense of the consequent repairs and the humiliation of having to send the best of this work to New York, it would not be surprising to find that Canada desired to have for herself a dock large enough, and a firm of character high enough, to deal with any class of work.

The Castle liner "*Edinburgh Castle*" approaches the launching stage. Large and handsome as this vessel is, she is completely dwarfed by the huge *Olympic* in the adjoining berth. It has often been remarked, even by the experienced, that the fine proportions and beautiful lines of the Queen's Island monsters prevent them from looking their real size, and that it is only when in juxtaposition such as that mentioned, that their magnitude can be properly appreciated. The R.M.S.P.Co.'s steamer *Balantia* will be off the stocks before these notes are in print.

Messrs. Workman, Clark & Co. have delivered the handsome Corry liner *Star of Japan*, the first twin-screw steamer owned by this Company. The Orient liner *Orvieto* has been dry-docked and will shortly undergo her trials. Another "fruiter," the *Metapan*, has been launched, so that there is a fleet of these vessels in the water, *viz.*, *Almirante*, receiving her finishing touches; *Santa Marta*, with machinery all on board; and *Metapan*, receiving hers at the crane. The Italian steamer *Verona* has been dry-docked by the builders and re-delivered to her owners, and the Lloyd Brazileiro *Rio de Janeiro* is nearly ready for sea.

Messrs. MacColl & Co. have received the order for a set of triple engines of 700 I.H.P., duplicate of a set made by them for Vancouver last year. The hull will be built by The Dublin Dockyard Co.

Harbour Master.—The Harbour Commissioners have appointed Captain McIntyre Harbour Master of Belfast in place of the late Captain Molyneux, whose sudden and lamented death was recorded last month. The Commissioners selected Captain McIntyre from over 200 applicants, and have shown their appreciation of their public responsibility by appointing what they considered the best man, in spite of some public clamour for the recognition of local claims only. Captain McIntyre's experience at Grangemouth, where he has been more than Harbour Master for over six years, should be of great value, and his success in Belfast will be made easier by the loyal co-operation of those above and around him, as well as of those directly responsible to him.

THE WORSHIPFUL COMPANY OF SHIPWRIGHTS.—Lord Pirrie, K.P. (master), entertained the Court of the above Company at dinner in a private room at the Carlton Hotel on Wednesday evening, 13th inst. Covers were laid for thirty. Among those invited were the Right Hon. Lord Allerton, the Right Hon. Sir Edward Clarke, K.C., P.C., Sir Joseph Savory, Bart., (past master), Sir W. H. White, K.C.B., F.R.S. (twice master), Sir Philip Watts, K.C.B., F.R.S., Sir Charles Scotter (twice master), Sir W. H. Dunn, Mr. H. Colin Smith (Prime Warden of the Fishmongers' Company), Mr. A. W. Aston, (Master of the Skinners' Company), Mr. J. Bruce Ismay (White Star Line), Mr. H. A. Sanderson (White Star Line), Mr. W. Lund (Blue Anchor Line), Dr. Clement Godson, M.D., Mr. H. Graham Harris, Member Inst.C.E., Mr. J. Bell White, Mr. J. H. Anderson, Mr. E. C. Kirkness, Mr. J. Johnson, Mr. John Weir, Mr. John Wrench Towse, Mr. E. Herbert Draper, Mr. J. M. Wright, Mr. A. E. Neary, Mr. L. N. H. Bailey, Mr. Henry A. Glyne, Mr. J. H. Silley, Mr. John L. Sayer, Col. T. Davies Sewell, and Mr. H. W. Sewell. Toasts were conspicuous almost by their absence, except that imperial loyalty impelled His Lordship to drink the King's health, and a guest insisted on recognising the Master. A pleasant evening was passed, presided over by a most hospitable and genial host.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Highcliffe.—On August 18th, Messrs. John Readhead and Sons, Ltd., West Docks, South Shields, launched a steel screw steamer, built to the order of Mr. John Readhead, Rockcliffe, and intended for the Cliffe Steamship Co., Ltd., of which Messrs. George T. Readhead are the managers. The vessel is of the single-deck type, and of the following dimensions:—Length, 346½ ft. overall; breadth, 47 ft. 6 in.; depth moulded 25 ft. 1½ in., and has been built to Lloyd's highest class on the three-deck rule. She is fitted with a double bottom all fore and aft, and large after-peak tank also for water ballast. A full equipment of steam winches and derricks are fitted for the rapid loading and discharging of cargoes. Her engines, also constructed by Messrs. John Readhead & Sons, Ltd., are of the triple-expansion type, having cylinders 23½ in., 39 in. and 65 in. by 45 in. stroke, supplied with steam from two large steel boilers working at a pressure of 180 lbs. per square inch.

Steersman.—On August 26th, Messrs. Wood, Skinner and Co., Ltd., successfully launched from their shipbuilding yard at Bill Quay-on-Tyne, a new steel screw steamer which has been built by them to the order of Messrs. C. Rowbotham and Sons, of London. The vessel is of the raised quarter-deck type, with bridge and topgallant forecastle and will be rigged as a three-masted schooner. Water ballast is provided in cellular double bottom and in the fore-peak tank. The vessel has an extra large hatch and will be fitted with every improvement and appliance for facilitating the rapid loading and discharging of cargo of a heavy character, which she is specially designed for carrying. The engines, which are of the triple-expansion type, have been constructed and will be fitted by Messrs. North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne. Both the ship and machinery have been built to the requirements and under the special survey of Lloyd's for their highest classification.

Bendew.—On August 30th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., launched from the Middleton Shipyard, Hartlepool, the steel screw steamer *Bendew*, built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, for Mr. Joseph Hoult, of Liverpool. The *Bendew* is 360 ft. in length by 51 ft. by 25 ft. 6 in. depth moulded, carrying over 6300 tons on the light draught of 21 ft. 5 in. The vessel is of the single-deck type, having absolutely clear holds, with poop, bridge and forecastle and is built to the highest class under British Corporation Registry. Cellular double bottom is fitted throughout and large fore and after peaks for water ballast; she is constructed with deep frames and longitudinal stringers, giving clear holds for the stowage of bulky cargo, and is divided into seven water-tight compartments by means of six water-tight bulkheads. Wood grain divisions are fitted throughout the holds according to the latest Board of Trade regulations. Four extra large cargo hatches are provided, with six powerful steam winches worked from a multitubular donkey boiler, and all the latest improvements are included for the rapid loading and discharging of cargo. A powerful quick-warping steam windlass is fitted forward, steam and hand-steering gear amidships, with hand screw gear aft. The engines are of the triple-expansion type by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, with cylinders 25 in., 40 in., 67 in. by 45 in. stroke, with two boilers 16 ft. by 10 ft. 6 in., working at a pressure of 180 lb. per square inch.

Querida.—On August 31st, the *Querida*, which has been built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., at their Neptune Works for the Donald Steamship Co., Inc., of Bristol and New York, was launched at Walker-on-Tyne. The vessel is 230 ft. long between perpendiculars by 36½ ft. beam, and is constructed of steel on the deep frame principle to Lloyd's 100 A1 class. She is intended for trade on the North Atlantic coast, and has special strengthening for ice. The deadweight capacity is about 2000 tons on a mean draught of 16 ft., and ample and up-to-date appliances are arranged for loading and discharging. The propelling machinery will consist of single-screw triple-expansion engines, and these, together with the boilers, are being supplied by the North-Eastern Marine Engineering Co., at Wallsend.

Vogesen.—On August 31st, Messrs. Wm. Doxford & Sons, Ltd., launched from their yard at Pallion a large single-deck steamer, with poop, long bridge and forecastle, built to the order of H. Vogemann, Esq., Hamburg, under the superintendence of Mr. L. Krenzien. The vessel, which is named the *Vogesen*, is 350 ft. long, 51 ft. broad, and of 25¼ ft. moulded depth, carrying 6450 tons deadweight on a light draught. Special provision is made for grain carrying. The classification is with the British Corporation, and their new departure of wide frame spacing is introduced in the construction of the hull. The engines and boilers are also supplied by Messrs. Doxford.

Breynton.—On September 1st, Messrs. William Gray and Co., Ltd., launched the handsome steel screw steamer *Breynton*, which they have built to the order of Messrs. Ralph E. Morel & Co., Cardiff. The vessel will take the highest class in Lloyd's and is of the following dimensions, *viz.* :—Length, overall, 376 ft. 6 in. ; breadth, 50 ft. 9 in., and depth, 28 ft. 4½ in., with extra long bridge, poop and topgallant forecastle. The hull is built with deep frames giving large clear holds, cellular double bottom and large aft-peak ballast tank, eight steam winches, steam-steering gear amidships, hand screw gear aft, patent direct steam windlass, steel grain divisions, stockless anchors, telescopic masts with fore and aft rig and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by The Central Marine Engine Works of the builders, having cylinders 26 in., 42 in. and 70 in. dia., with a piston stroke of 45 in. and three large steel boilers for a working pressure of 180 lbs. per square inch.

Winnebah.—On September 2nd, there was launched from the Harbour Dockyard of Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, the steel screw steamer *Winnebah*, a duplicate of the s.s. *Shonga*, recently launched from the same yard for Sir Alfred Jones, K.C.M.G. (Messrs. Elder, Dempster & Co., Liverpool). The *Winnebah* is a beautifully modelled vessel, having fine lines and being specially designed, with main, upper and shelter decks and poop, bridge and forecastle on top of the shelter deck, and the dimensions are :—Length, 355 ft. ; beam extreme, 46 ft. and 25 ft. 3 in. depth moulded to upper deck. She is classed 100 A1 at Lloyd's and has cellular double bottom all fore and aft, with after-peak tank for water ballast. The vessel is divided by six transverse bulkheads into seven water-tight compartments. Every attention has been paid to all appliances for the rapid loading and discharging of cargo, the ship having ten powerful steam winches of the builders' own design and ten derricks capable of lifting five tons each. Provision is made on each mast for a special derrick capable of lifting fifteen tons, whilst the whole of the mast arrangement is strengthened to lift 40 tons. In the poop a large icehouse, mail room, paint room, lamp room and general store rooms are provided, and separate mess rooms and wash places are provided for the crew, and by the thoughtfulness of Sir Alfred L. Jones a library containing a judicious selection of well-known novels is furnished for their special use, and will no doubt be heartily appreciated. A complete installation of electric light has been fitted by Messrs. Campbell and Isherwood, Liverpool, including signal lamps, binnacles and cargo clusters at each cargo hatch, as well as oil lamps for emergency purposes. Steam-steering gear is placed amidships, which leads aft to quadrant led alongside the hatches. There is a quick-warping windlass forward, and large multitubular donkey boilers of ample capacity for the supply of steam to the deck and auxiliary machinery. The engines are of the triple-expansion type by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 25 in., 40 in. and 67 in. by 45 in. stroke, with two boilers 16 ft. 6 in. by 10 ft. 9 in., working at a pressure of 180 lbs. per square inch, and capable of driving the vessel at a fair rate of speed when loaded.

Guanabacoa.—On September 4th, a successful launch took place at the yard of Messrs. Cammell, Laird & Co., Ltd., Birkenhead, of the double-ended steel screw ferry steamer *Guanabacoa* being constructed for the Havana Central Railroad Co., Ltd., of New York. The vessel has a length of 140 ft., breadth 55 ft., depth 14 ft. 8 in., with a draught of 8 ft. 6 in.; she is fitted with C.S.C. engines, two water-tight tube boilers, two handsome saloons each 86 ft. long, large promenade upper deck, special cart ways 12 ft. 6 in. clear in height, electric light throughout. The fittings are on a most extensive scale, the saloon windows being 5 ft. by 2 ft. 6 in., the decorations are of carved oak with vellum relief for panels. The vessel is of a type rarely seen in this country, and will prove a valuable addition to the owners' fleet at Havana, Cuba.

Parisiana.—On September 15th, there was launched at Howdon-on-Tyne the steamer *Parisiana*, which has been built for Messrs. Furness, Withy & Co., Ltd., of London and West Hartlepool. The steamer will be fitted with all the latest improvements and up-to-date appliances to make her in every way a first-class liner. She is 422 ft. in length and 52 ft. beam, with three complete steel decks. The propelling machinery, which is being constructed by Messrs. Palmer's Shipbuilding and Iron Co., Ltd., of Jarrow, consists of engines with cylinders 28 in., 46 in., 77 in. by 45 in., taking steam from three boilers 15 ft. 3 in. by 11 ft. 6 in., 200 lb. working pressure, constructed to the requirements of the Hamburg police, and fitted with forced draught to attain a speed of 12 knots laden. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the boiler-room tank and tank top.

Ashtree.—On September 16th, Messrs. Craig, Taylor and Co., Ltd., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a finely modelled steel screw steamer of the following dimensions, *viz.* :—255 ft. 9 in. by 36 ft. 9 in. by 18 ft. moulded. She is built of steel to the highest class in Lloyd's under special survey, and has raised quarter deck, bridge house and topgallant forecastle, water ballast in double bottom fore and aft, and in peaks. She is equipped with patent steam windlass with quick-warping ends, steam-steering gear, four steam winches, and suitable donkey boiler, pole masts to Manchester Ship Canal requirements, large hatches for self-trimming, and all the latest improvements for rapid loading and discharging. Her engines have been constructed by the North-Eastern Marine Engineering Co., Ltd., Sunderland, the cylinders being 19 in., 31 in., 51 in. by 36 in., with two large steel boilers working at 180 lbs. pressure. The vessel has been built to the order of Messrs. Howard-Jones & King, of Cardiff, under the superintendence of Mr. Henry Cambridge, of Cardiff.

Salvador.—On September 16th, there was launched from the Neptune Works of Messrs. Swan, Hunter & Wigham Richardson, Ltd., a steamer which is being constructed for the new service of the Salvador Railway Co., Ltd., along the coast of Salvador, Central America. This vessel is 225 ft. overall, with a beam of 33½ ft., and has been built under special survey to class 100 A1 Lloyd's. The vessel is fitted by the builder with triple-expansion engines of ample power to attain a speed of 11 knots on service when loaded with a cargo of coffee. Accommodation for twenty first-class passengers is arranged in deck houses amidships. The vessel has teak decks and the general outfit is of a high order and in every way suitable for the special trade for which she is intended. There is electric light throughout, and electric ventilating fans are placed in each state-room. She has been completed in only sixty-four working days, which is believed to be a record for a steamer of this class and type.

Natalia.—On September 28th, Messrs. Swan, Hunter and Wigham Richardson, Ltd., launched from their Neptune Works, Newcastle-on-Tyne, a steel screw steamer which they are building to the order of the Linea de Vapores Serra, of Bilbao, Spain, whose agents in England are Messrs. W. T. Nickels and Gordon Ross, of Liverpool. The vessel, which is being built under the survey of the British Corporation, is 200 ft. in length by 42 ft. beam, and is designed to carry 3250 tons deadweight on a moderate draught of water. The propelling machinery consists of a set of triple-expansion engines, supplied with steam by two natural draught boilers, all of which are being constructed at the Neptune Works. The vessel is intended for the "Serra" Co.'s line between Liverpool and Spain.

Togston.—On September 28th, Messrs. Osbourne, Graham and Co. launched from their yard at Hylton the s.s. *Togston*, which they have specially constructed to the order of Messrs. Furness, Withy & Co., Ltd., of West Hartlepool, for the Broomhill Collieries, Co. Ltd. The vessel is built on the raised quarter-deck principle, having bridge amidships for accommodation. She is 218 ft. in length and carries 1550 tons on a light draught. The steamer is arranged as a self-trimmer,

and is classed under special survey with the British Corporation. Water ballast is in the double bottom and after peak. The deck machinery is of the most modern description. The vessel is fitted with engines by Messrs. Richardsons, Westgarth & Co., Ltd., of Sunderland, having cylinders 16 in., 27 in., 44 in. by 30 in., and one large boiler 180 lbs. pressure. A Cochran (Annan) donkey boiler with patent seamless furnace has been fitted.

Netherpark.—On September 30th, there was launched at Howdon-on-Tyne a steamer, built to the order of Messrs. John Greenlees & Sons, of Glasgow. The vessel is 395 ft. long by 49 ft. 9 in. beam by 29 ft. deep, and has been built under special survey to the highest class at British Corporation. The propelling machinery will be supplied by the North-Eastern Marine Engineering Co., Ltd., of Wallsend, consisting of engines with cylinders 24½ in., 40 in. and 68 in. by 48 in. stroke, three large steel boilers 14 ft. 6 in. by 11 ft., 180 lb. pressure. The vessel is designed to carry about 7300 tons deadweight on 23 ft. 8 in., and steam about 10 knots loaded at sea. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering was applied to the tank top in boiler room and their "Bitumastic" enamel to the tank margin plating.

Westgarth.—On September 30th, Messrs. Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyards, Middlesbrough-on-Tees, a fine steel screw cargo steamer to the order of Messrs. R. & J. H. Rea, of Liverpool, Cardiff and Southampton, to fulfil the very special requirements of the owners' extensive coal carrying trade. The vessel is being constructed under special survey to class 100 A1 at Lloyd's. Her principal dimensions are 252 ft. by 36 ft. 3 in. by 20 ft. 9 in. moulded, and she will have a deadweight carrying capacity of about 2320 tons on a light draught of water. Triple-expansion engines having cylinders 18 in., 30 in. and 50 in. by 36 in. stroke supplied with steam by two large single-ended boilers working at 180 lbs. pressure will be fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Middlesbrough. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Treveal.—On September 30th, there was launched from the Shipbuilding Yard of Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, a steel screw steamer built to the order of Messrs. Edward Hain & Son, St. Ives, Cornwall, and named *Treveal*. She is of the improved single-deck type to Lloyd's highest class, having poop, long bridge and topgallant forecastle, with deep girder framing, and having cellular double bottom all fore and aft, and with large afterpeak tank for water ballast. Steel houses are built on the bridge deck for the accommodation of the captain, officers, etc., and also for the engineers and apprentices. The outfit of the ship is very complete for general and grain trades, with shifting boards all fore and aft and trunk feeders as hatchways. A full equipment of steam winches and derricks is fitted for the rapid loading and discharging of cargoes. The vessel has been built to carry a deadweight cargo of over 7000 tons on a light draught of water. The vessel will be fitted with triple-expansion engines, also constructed by Messrs. John Readhead & Sons, Ltd., having cylinders 35½ in., 42 in. and 69 in. and 48 in. stroke, supplied with steam from two large steel boilers working at a pressure of 180 lbs. per square inch.

Germaine.—On September 30th, there was launched from the yard of the Sunderland Shipbuilding Co., Ltd., a steel screw steamer, 246 feet B.P. by 34 ft. 3 in. breadth extreme, by 16 ft. 9 in. deep, having raised quarter deck, bridge and top-topgallant forecastle, classed 100 A1 Lloyd's, under special survey. The vessel will carry about 1900 tons deadweight, and is fitted with water ballast in cellular bottom and peak tanks. Accommodation is placed partially on top and partially underneath bridge for captain, officers and engineers. The saloon is amidships, and is fitted up in polished hardwoods. Four steam winches, steam-steering gear and direct steam windlass are fitted. The engines are by the North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 18 in., 30 in. and 49 in. by 36 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch. The vessel has been built to the order of Mons. Fernand Bouet, of Caen, and during construction has been inspected by Messrs. Swan and MacFarlane, Newcastle.

LAUNCHES Scotch.

Strathalbyn.—On September 21st, Messrs. Archd. McMillan and Son, Ltd., Dumbarton, launched the steel screw steamer *Strathalbyn*, the first of two vessels they are building to the order of Messrs. Burrell & Son, Glasgow. The vessel is of the following dimensions, *viz.*:—Length, 390 ft.; breadth, 52 ft. 3 in.; depth, 28 ft., and is constructed with clear holds. Large water ballast capacity is provided for in cellular double bottom, aft peak, and in deep tank amidships. All up-to-date appliances are provided for the rapid handling of cargo, including twelve derricks and ten powerful steam winches. Electric light is installed throughout the vessel. The machinery is being supplied by Messrs. John G. Kincaid and Co., Ltd., Greenock, and both vessel and machinery have been built under special survey of the British Corporation for their highest class.

Bellucia.—On September 28th, there was launched from the shipbuilding yard of Messrs. David & William Henderson and Co., Ltd., Meadowside Works, Partick, a steel screw steamer, which they have constructed to the order of Messrs. Bell Bros. & Co., Glasgow and London. The vessel's dimensions are 400 ft. by 51 ft. by 28 ft., with a gross tonnage of 4,400 tons, and a deadweight cargo capacity of about 7,200 tons on a light draught. The vessel is replete with every convenience that can add to the rapid loading and discharging of cargo, including twelve derricks and ten steam winches. Large and commodious accommodation is provided on the bridge deck for captain, officers, and engineers. The machinery, which has also been constructed by the builders, is of the triple-expansion type, having cylinders 25 in., 41 in., and 68 in. diameter by 48 in. stroke; steam is supplied by three single-ended boilers and one large donkey boiler. Hull and machinery have been constructed in accordance with the requirements of the British Corporation and will have their highest class.

Strathroy.—On September 29th, there was launched at Port Glasgow the steamer *Strathroy*, which has been built to the order of Messrs. Burrell & Son, Glasgow. The vessel has a deadweight capacity of 7,510 tons. The naming ceremony was performed by Miss Burrell, Glasgow, daughter of one of the owners. After the launch the vessel was towed to Glasgow to be fitted with her machinery. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the engine and boiler-room tanks, engine-room tank top, bunkers, and fresh-water tank, and their "Bitumastic" covering to the tank top in boiler room.

Parkmill.—On September 30th, the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, launched a steel screw steamer 235 ft. by 36 ft. by 17 ft. 3 in., to Lloyd's highest class, for Messrs. T. P. R. Richards, Turpin & Co., Swansea, under the superintendence of Captain J. H. Donald, Swansea. The vessel was named *Parkmill*, and immediately after the launch, was placed in the Company's dock to receive her machinery, which has also been constructed by the builders. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Norman Monarch.—On September 30th, there was launched by Messrs. Napier & Miller, Ltd., Old Kilpatrick, the steel screw steamer *Norman Monarch*, which they have built to the order of the Monarch Steamship Co., Ltd. (Messrs. Raeburn & Vérel, Managers). The vessel has been built to the highest class under the British Corporation rules. The principal dimensions are, length between the perpendiculars, 400 ft.; breadth, 52 ft.; depth, moulded, 30 ft.; with a gross tonnage of about 5,000 tons. Water ballast has been provided in a cellular double bottom and also in aft peak and a large deep tank abaft the engine room. The vessel has a most complete and convenient arrangement of hatches, derricks and nine winches for the rapid handling of cargo, with electric light fitted throughout. The machinery, which is being supplied by Messrs. Dunsmuir & Jackson, Ltd., Govan, consists of triple-expansion engines with cylinders 27 in., 44 in., and 73 in. respectively, and 48 in. stroke. There are two boilers of large size with Howden's forced draught, and a donkey boiler. Messrs. Wailes, Dove and Co.'s covering has been applied to the tank top in boiler room and their enamel in boiler-room tank and boilers.

Hapal.—There has been launched at Paisley a twin-screw bucket hopper dredger, built to the order of the Auckland Harbour Board, New Zealand. The vessel is of the stern-well type, and is designed to raise 1,200 tons per hour from a depth of 45 feet below water level. The vessel was named *Hapai*.

Carron.—On October 14th, Scott's Shipbuilding and Engineering Company, Greenock, launched a steel screw steamer built to the order of the Carron Company for their trade between Grangemouth and London. The vessel, which was designed by Mr. A. M. Gordon, Glasgow, and will take Lloyd's highest class, is of about 2,300 tons gross, 308 ft. in length, 40 ft. 6 in. in breadth, and 20 ft. in depth. She has a combined bridge and poop and a topgallant forecastle. The rig will be that of a two-masted fore and aft schooner, with one funnel. Water ballast is arranged for to the double bottom and peaks, and there are three cargo holds. Accommodation is provided for 122 first-class and 78 second-class passengers. By superimposing an upper bridge on the ordinary bridge deck a spacious dining saloon, extending to the full width of the ship, is provided, and state-rooms of unusual area. The dining saloon is a very handsome apartment, lighted by large rectangular windows, and at night by numerous electric lamps. The side panelling is in richly figured mahogany, decorated with inlay and carvings, while lincrusta panels are effectively introduced in the design of the ceiling. A very striking feature in the saloon is the fireplace. Behind a pillared alcove, surrounded by a handsomely carved mantelpiece, it presents a remarkable combination of art and utility. The brass letters of her name and the huge windlass, weigh over 8 tons, for lifting her anchors; the delicately wrought ormolu crest on her stern and the powerful steering engine have been supplied by her owners. Of their own design are the hydraulic cranes on deck, while the sidelights, the hinges of the cargo doors, the baths, the deck seats, the ornamental chair and table stands, the hawse pipes and timberheads, will all owe their production to the work of the Carron Company's employees. The upper bridge deck forms a promenade for the first-class passengers, and on it are situated a handsome vestibule, off which opens the smoke-room, panelled in polished mahogany. A special feature of the passengers' quarters is the separation of a part of the starboard side for ladies' state-rooms. On the main deck are also situated the officers' and engineers' quarters, entirely apart from the passenger spaces, only the captain being berthed on the upper bridge-deck. In the poop are the saloon and state-rooms for second-class passengers, with an entrance-house and smoke-room above. Under the forecastle are the crew's quarters and rooms for deck passengers. The vessel is fitted with triple-expansion surface-condensing engines. The cylinders are: high pressure, 28 in. diameter; intermediate, 45 in. diameter; and low pressure, 72 in. diameter, with a piston stroke of 42 in. Steam is supplied by four single-ended boilers, each 16 ft. diameter by 11 ft. in length, constructed for a working pressure of 180 lb. Forced draught is arranged on the closed stokehold system, and two large steam-driven fans are fitted in the engine-room for this purpose. The vessel has been designed for a speed of 15 knots on service.

Grantully Castle.—On October 14th, Messrs. Barclay, Curle & Co., Whiteinch, launched the second vessel named *Grantully Castle*, which they have built for the Union-Castle Mail Steamship Company to the order of Messrs. Donald Currie & Co. The first Grantully Castle was constructed by them in 1879, but the business connection between the two firms has extended over a period of fifty-five years, during which time Messrs. Barclay, Curle & Co. have constructed fifty-eight vessels for Messrs. Donald Currie & Co. The new liner, which is intended for the intermediate service to South Africa, is one of four placed in December of last year—two intermediate steamers with Messrs. Barclay, Curle & Co., one mail steamer with the Fairfield Shipbuilding and Engineering Company, Govan, and one of a similar type with Messrs. Harland & Wolff, Belfast. The *Grantully Castle* is twin-screw, and is constructed of steel throughout, to the highest requirements of Lloyd's Register and the Board of Trade. She is 464 ft. in length, 54 ft. 3 in. in breadth, 33 ft. 0 in. in depth, and of about 8,000 tons gross. She has three steel decks, a combined poop and bridge, a long forecastle, and boat deck amidships and aft. All the exposed decks are sheathed in teak, and ample space is provided for promenades for all classes of passengers. A double bottom is fitted the full length of the hull, and there are a large number of watertight bulkheads. Accommodation will be provided for about 100 first-class, 100 second-class, and 200 third-class passengers. In addition the 'tween decks are arranged fore and aft for troops or emigrants. The first-class passengers will be berthed in rooms on the upper and bridge decks, and the second-class entirely on the upper deck. The accommodation is of the highest character, the cabins being fitted generally with two berths. The dining-rooms, smoking-rooms, drawing-rooms, libraries, and entrances will all be handsomely furnished and decorated. The third-class passengers will be berthed in large, separate cabins of two, four and six berths each, under the poop deck and in the after portion of the upper 'tween decks. They will have a large dining saloon, a smoking-room, and a ladies' lounge. The vessel will be provided with facilities of the most complete description for handling cargo. These will include a derrick capable of lifting 20 tons, and also eleven powerful winches. Fourteen boats will be provided. The machinery will consist of two sets of quadruple-expansion balanced engines, constructed by the builders, supplied with steam from two large double-ended boilers and one single-ended boiler, and of sufficient power to give a sea speed of about 13 knots. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering has been applied to the tank top in boiler room, and donkey boiler recess, and their enamel to ship's sides, etc., in boiler room, also in refrigerating rooms, larder and ice house.

LAUNCH—Irish.

Metapan.—On October 14th, Messrs. Workman, Clark and Co., Ltd., launched from their North Yard a large handsomely modelled steamer built to the order of the Tropical Fruit Steamship Co., Ltd., Glasgow (Messrs. Clark & Service, Managers). The vessel was named *Metapan*, the christening ceremony being gracefully performed by Miss Ackerley, of London. The *Metapan* has been specially designed for the West Indian banana and general fruit and refrigerated freight trades between the West Indian and United States ports, and has very commodious and comfortable accommodation for a large number of passengers. The public and private rooms have all been arranged with a view to securing the maximum of pleasure and comfort for those who travel by these steamers, the decorations and furnishings being of the most artistic and luxurious character, while the rooms are well lighted and ventilated throughout. The eight compartments into which the cargo space is divided have been insulated and prepared for the carriage of fruit in bulk, and the delivery of these cargoes in marketable condition is ensured by an efficient installation of refrigerating machinery, the cooled fresh air being delivered through ducts to each of the compartments by electrically-driven fans. The vessel will be propelled by a set of improved triple-expansion engines constructed by the builders at their Queen's Road Works and designed to drive her at a speed of about 15 knots. The *Metapan* is 394 feet in length, with a gross tonnage of over 5,000, and has been built under special survey for the highest class (R.B.S.*) in the British Corporation Registry of Shipping, while the requirements of the British Board of Trade and the United States Steamship Passenger Inspection Service will also be fully complied with.

TRIAL TRIPS.

Heatherside.—On August 9th, the ss. *Heatherside*, lately launched by Messrs. Short Brothers, Limited, from their shipyard at Pallion, Sunderland, to the order of The Charlton Steam Shipping Co., Limited (Messrs. Charlton, McAllum and Co., Managers), Newcastle-on-Tyne, left the Wear for her official trials. The propelling machinery, which throughout the trial worked very satisfactorily, is by Messrs. John Dickinson & Sons, Limited, Sunderland, and consists of engines with cylinders 23 in., 38 in., 62 in. diameter by 42 in. stroke, taking steam from two large multitubular boilers working at 180 lbs. pressure. On the trial runs, the steamer maintained a speed of 11 knots. The hull and

machinery have been built under the supervision of Mr. Jos. R. Scott, of Newcastle. (See also Launches, October issue).

Bruxellia.—On August 31st, the trial trip of the new steamer *Bruxellia*, constructed on the Wear for the Ghent-Lloyd Steamship Company, of Ghent (Messrs. T. Nolson & Co., managers), took place. On the trial the engines developed 1,200 horse power and a speed of more than 11 knots was attained. The steamer has gone into Tyne Dock to load her first cargo for the Baltic. Speaking at the luncheon on board the steamer, Mr. Spaey and Mr. Nolson dwelt upon the excellent results obtained by their new steamers, and stated that they hoped shortly to be able to order another vessel of 5,000 tons from the Ghent-Lloyd, of the same type as the Russia, now building on the Wear for the Société d'Armement Belge-Gentoise. (See also Launches, October issue).

Prinses Juliana.—On September 2nd, the twin-screw steamer *Prinses Juliana*, built by the Fairfield Shipbuilding and Engineering Company (Limited) for the Zeeland Steamship Company, of Flushing, ran a series of trials over the measured mile at Skelmorlie. Commencing at 11 knots various runs were made over the mile at gradually increasing speeds until a rate of 22½ knots was attained, when, in view of further trials to be carried out in the North Sea, it was decided to continue for a period of several hours at the revolutions corresponding to the high speed attained. When the vessel was well down the Firth a number of circling, stopping and reversing trials were made. All through the speed and other trials the absence of vibration in a vessel of such speed was very marked. The *Prinses Juliana* is the first of three vessels the Zeeland Company have ordered from the Fairfield Company, and she will shortly take up the night service between Queenborough and Flushing. The *Oranje Nassau*—the second vessel of the three—is now being fitted out in the Fairfield Basin, while the third is still on the stocks. Messrs. Matthew Keenan & Co., Ltd., have completed the entire boiler and steam pipe covering work for this boat and also for her sister ship the *Oranje Nassau*. The Zeeland Company were represented on the trial by Mr. de Meester, the general manager, and Mr. Kromwijk, superintendent engineer; Mr. Gracie, Mr. Sampson, and Mr. Alex. Cleghorn represented the builders.

Florinda.—On September 16th, the *Florinda*, the latest addition to the fleet of the Linea de Vapores Serra of Bilbao (Spain), left the Tyne immediately on the conclusion of a very successful trial trip. The steamer is 290 feet in length by 42 feet beam, and carries over 3,250 tons deadweight on a moderate draught of water. The propelling machinery consists of a set of triple-expansion engines, supplied with steam from two boilers. These have all been built at the Neptune Works, and on the trial trip worked without the slightest hitch, driving the vessel at a speed of over 11½ knots per hour. The Serra Company were represented by Mr. Geo. Nickels, of the firm of Messrs. Nickels & Ross, Liverpool, their English agents. On the conclusion of the trial trip the vessel sailed under the command of Captain Cirarda.

Queen Eugenie.—On September 16th, the steel screw steamer *Queen Eugenie*, constructed at Howdon-on-Tyne, to the order of Messrs. Thomas Dunlop & Sons, of Glasgow, left the Tyne for her trial trip. The steamer is 395 feet long by 49 feet 9 inches beam and 29 feet deep. The trial trip proved satisfactory and a speed of 11½ knots was obtained, after which the vessel proceeded on her voyage to Valparaiso, under the command of Captain Currie. (See also Launches, October issue).

Bendew.—On September 18th, the steel screw steamer *Bendew* proceeded from Hartlepool Harbour to undergo her official trial trip. The machinery, which worked most satisfactorily throughout the trials, has been supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, The sizes of cylinders are 25 in., 40 in., 67 in. by 45 in. stroke, with two boilers 15 ft. by 10 ft. 6 in., working at 180 lbs. per square inch. The vessel easily maintained a speed of twelve knots over a series of runs. The owner was represented by Mr. B. Allen, the shipbuilders by Mr. A. S. Purdon, and the engineers by Mr. G. Urquhart. (See also Launches).

Highcliffe.—On September 20th, the new screw steamer *Highcliffe*, built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of Mr. John Readhead, Rockcliffe, was taken to sea on her official trial trip. The trial was in every way satisfactory to all concerned; the vessel afterwards proceeded into Tyne Dock to load for Porto Vecchia, under the command of Capt. Swinbanks. (See also Launches).

Lancer.—On September 20th, the fine new steel screw steamer *Lancer*, built by Messrs. Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on-Tyne, to the order of Messrs. Fisher, Renwick & Co.'s Manchester-London Steamers (1908), Ltd., left the Tyne for her official trial trip. During several runs over the measured mile the machinery worked very smoothly, maintaining a speed of over 12 knots, and giving every satisfaction to all present. (See also Launches, October).

Belgique.—On September 23rd, the fine new steel screw steamer *Belgique*, built by Messrs. Wood, Skinner & Co., Ltd., Bill Quay-on-Tyne, to the order of Messrs. Société Anonyme "Baltique," managing owners Messrs. Giani and Muller, Antwerp, left the Tyne for her official trial trip. This vessel is of the single-deck type, with full poop, bridge and topgallant forecastle, water ballast being provided in cellular double bottom all fore and aft and in the fore and after-peak tanks. The vessel has been built under the special survey of Lloyd's, for their highest class, and has all the latest improvements for the rapid handling of cargo. The propelling machinery, which has been constructed at the Northumberland Engine Works of Messrs. The North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, consists of a set of their latest triple-expansion engines having cylinders 20 in., 33 in., 54 in. with a stroke of 36 in., steam being supplied by two large steel boilers working at a pressure of 180 lbs. per square inch. During the trial runs the machinery worked without the slightest hitch and gave great satisfaction to all concerned.

Gladstone.—On September 24th, the ss. *Gladstone*, built by Messrs. Ropner & Sons, Limited, of Stockton-on-Tees, made her official trial trip in the Tees Bay. The vessel has been built under superintendence of Captain Olsen, of Bergen, the Commander of the vessel, and on trial she behaved herself in a thoroughly satisfactory manner. The owners were represented by the Captain and the builders by Mr. J. R. Garthwaite. After some very satisfactory trial runs, during which the vessel attained a speed of over 11 knots, she went round to the Tyne, where she will load. (See also Launches, October issue.)

Graceful.—On September 25th, the ss. *Graceful*, built by Messrs. W. Harkess & Son, Ltd., of Middlesbrough, to the order of Messrs. The British & Continental Steamship Co., Ltd., of Liverpool, was taken for her official trial trip, when a speed of 10½ knots loaded was maintained, and everything worked to the entire satisfaction of the owners. Her dimensions are 195 ft. by 30 ft. by 13 ft. 10 in. moulded. The vessel loaded a cargo of 1,075 tons of light coal on a mean draught of 13 ft. 3 in. The machinery was supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Middlesbrough, consisting of a set of triple-expansion engines with cylinders 16 in., 27 in., 44 in. diameter by 30 in. stroke, and are supplied with steam at 180 lbs. pressure from two cylindrical boilers. The patent "Contraflo" condensing system, with special temperature regulating valve, forms an interesting feature of the machinery, and at full speed a high vacuum was easily maintained. Owing to the economical results obtained with this new condensing system, Messrs. Richardsons, Westgarth and Co. have now completed or have in hand fifteen sets of marine engines which have this arrangement of condenser.

Querida.—On September 25th, the steamer *Querida*, was taken to sea for her trials. Captain T. L. Evans, of Bristol, the company's manager and secretary, under whose supervision the construction has been carried out, and Mr. Buckland, of Newcastle, who has assisted, were present on the trial. The vessel sailed under the command of Captain Fitzpatrick, for Sydney, Cape Breton. (See also Launches.)

Steersman.—On September 28th, the ss. *Steersman*, a fine new steel screw steamer, built by Messrs. Wood, Skinner

and Co., Ltd., Bill Quay-on-Tyne, to the order of Messrs. C. Rowbotham & Sons, London, left the Tyne for her official trial trip. During the trial run the machinery worked without the slightest hitch, a mean speed of 11 knots being obtained, which was considered very satisfactory by all concerned. (See also Launches.)

Mataram.—On September 29th, the new Australian liner *Mataram*, built on the Clyde for Messrs. Burns, Philp and Co., Sydney (N.S.W.), ran her official trials. The trials proved satisfactory in every respect, and a speed of over 13½ knots was attained on an extended run. (See also Launches, September).

Strathesk.—The Greenock-built steamer *Strathesk* has completed fitting out. On her trial trip she attained a mean speed of 12½ knots. Immediately the speed trial was over the vessel sailed for Pensacola. (See also Launches, October).

St. Louis.—The powerful screw trawler *St. Louis* has been out for her official trial. The *St. Louis* has been built by Messrs. Jos. T. Eltringham & Co., to the order of Messrs. R. Hastie & Sons, North Shields, and is a sister ship to the *St. Lawrence*, delivered by the same builders to Messrs. Hastie early in August. The trial was in every way successful. The vessel afterwards proceeded to North Shields Fish Quay to take in stores, in preparation for her first voyage.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class 2C Second Class.

September 25th, 1909.

Annison, R. C. 1C N.Shields
Armstrong, M S 1C Leith
Balfour, J. .... 2C London
Barltrop, C. .. 1C London
Birrell, J....... 2C Leith
Bricknell, E. .. 1C Cardiff
Brown, T. .... 1C W. Hart'l
Burkett, Wm .. 2C N Shields
Campbell, G P. 2C Liverpool
Carr, A ...... 2C N Shields
Claireaux, A J 1C Leith
Cooper, T. .... 1C W Hart'l
Craig, J ...... 2C Leith
Cranwell, H .. 1C London
Dalton, F. M .. 2C Leith
Duff, P. ...... 2C Leith
Duncan, R. M 2C Glasgow
Dunn, A C. A. 1C Cardiff
Essenhigh, C.A 1C Plymouth
Gillan, S ...... 1C Leith
Hancock, F H 2C London
Hulsmeier, W C 2C N Shields
Izatt, J. S. .... 1C London
Keenliside, C... 1C Liverpool
Kennedy, J. E. 2C Liverpool
Keskeys, R. M 2C Plymouth
Lamb, E. W .. 2C N Shields
Ling, F. G. .... 2C Glasgow
Livingstone, H 1C N.Shields
Lord, H H .. 1C W Hart'l
M'Cormick, J S 2C Glasgow
M'Donald, A T 1C London
M'Dougall, W G 2C Cardiff
Maddison, R .. 1C W Hart'l
Miller, A. S .. 2C Glasgow
Mitchell, J F... 2C W Hart'l
Oram, C H .. 2C London
Purvis, C. H .. 2C N Shields
Randell, R .... 2C Cardiff
Rennie, J M .. 1C Liverpool
Ritchie, W H 2C Glasgow
Robinson, A V 2C W. Hart'l
Sawyer, T A .. 2C South'ton
Simpson, T .. 1C Leith
Smith, J M .. 1C Glasgow
Stark, A ...... 2C W Hart'l
Syrmas, D .... 2C N Shields
Thomas, P .... 2C London
Thomas, R .... 1C South'ton
Thompson, A .. 2C W. Hart'l
Thompson, J H 1C N.Shields
Ward, R H. .. 2C London
Wardman, T C. 2C W.Hart'l
Watkins, F. M 2C Liverpool
Whicher, S. P. 2C Cardiff
Williams, T. D 2C Cardiff
Williams V. G 2C Cardiff
Woodward, N W. 2C Cardiff

October 2nd

Adams, G P. .. 2C London
Anderson, R A 2C Aberdeen
Ashton, V E .. 1C Liverpool
Bailes, T....... 2C N.Shields
Calder, J M .. 2C London
Carruthers, D.A 1C Greenock
Collier, W .... 2C Liverpool
Copeland, C W 2C Hull
Couper, A .... 1C Greenock
Cran, A M..... 2C Aberdeen
Cushnie, W... 2C Aberdeen
Fraser, J .... 2C Aberdeen
French, H H. 1C London
Fyfe, J. ...... 1C London
Gleed, A. E. .. 1C Bristol
Goodwin, H T 2C London
Goulden, P..... 2C Hull
Graham, J. G 2C Greenock
Graham, J S 1C Greenock
Harding, F. .. 1C Sunderl'd
Jackson, E. A. 1C Liverpool
Jackson, W W 2C Sunderl'd
Jacobs, A. .... 2C London
Kinnear J A 2C Aberdeen
Lonergan, D .. 2C London
Long, G A .... 2C N Shields
Longstaff, T H 2C N Shields
Low, C. ...... 2C Aberdeen
McBain, J. .... 2C Aberdeen
M'Gugan, W .. 2C Greenock
Mackay, D .. 2C Liverpool
M'Leod, H .. 1C Greenock
McNair, T R 1C Liverpool
M'Nee, A .... 2C Bristol
M'Neil, W G. 1C Greenock
Marsh, W. .... 2C Liverpool
Millar, J....... 2C Greenock
Murison, A. G 2C London
Paterson, H. .. 2C Greenock
Paterson, P.S H 1C Aberdeen
Rapley, J. G .. 1C Sunderl'd
Russell M S 1C Greenock
Scorgie, G. .... 2C Greenock
Scott, R ...... 1C N Shields
Shannon, H S. 1C Greenock
Sharp, J .... 2C Greenock
Snoswell, B .. 1C London
Stevenson, W.J 2C N Shields
Stienlet, V H 2C N.Shields
Taylor, A .... 1C Liverpool
Taylor, W. .... 2C Sunderl'd
Thomas, R J 1C Liverpool
Thomson, P. .. 2C Aberdeen
Tim, H. C. .... 1C Aberdeen
Tose, R C .... 1C N Shields
Wigg, E C. .. 2C London

October 9th.

Arbuckle, J. .. 2C South'ton
Best, G L .... 2C London
Bigelon, A. G 1C N.Shields
Blacklock, B. L. 1C N Shields
Campbell, W... 1C Glasgow
Cochrane, W.M. 1C Glasgow
Conners, T..... 2C Liverpool
Cox, T. R. .... 2C London
Dalby, G. W... 1C N.Shields
Davies, M. O .. 1C South'ton
Day, F. E .... 2C South'ton
Dunbar, J .... 2C Liverpool
Duncan, W. .. 2C Glasgow
Ellis, C. ...... 1C London
Evans, W .... 1C Liverpool
Goodman, G. H. 2C Falmouth
Gray, W T. .. 2C London
Griffin, J. C .. 1C Liverpool
Hassan, H L .. 1C N Shields
Haveling, A. .. 2C Liverpool
Higgin, G B .. 1C London
Hornsby, W. .. 1C N.Shields
Imeson, J M .. 1C N.Shields
Ironside, G .... 2C Leith
Kirk, J M .... 2C Belfast
Lydon, M V .. 2C N Shields
McAnley, D .. 2C Belfast
MacDonald, R 1C Glasgow
M'Farlane, J... 1C Leith
M'Neil, A .... 2C Glasgow
Parker, V .... 1C N Shields
Paton, H. K .. 2C Glasgow
Perry, T....... 1C Liverpool
Petrie, J E..... 1C Leith
Pirie, A D,.... 1C N.Shields
Rickinson, J. P. 2C N Shields
Rintoul, R. .... 2C Glasgow
Sams, J G B... 1C Liverpool
Sinclair, H L .. 1C Liverpool
Sutherland, W 1C Glasgow
Tickell, W J. 1C South'ton
Tron, T W .. 2C South'ton
Walters, T. H. 2C Cardiff
Whalley, H G 1C London
Williams, R. .. 1C Cardiff
Wilson, D .... 2C Belfast
Wood, T. M .. 2C Leith

October 16th

Baker, W. C. .. 1C Liverpool
Birchall, A H 2C N Shields
Bowman, H Q 2C London
Chambers, J .. 2C N Shields
Clement, G H 2C London
Currie, D J .. 2C Greenock
Dexter, J ...... 2C Dublin
Eaglesome, A W. 1C Liverpool
Elson, W. H .. 1C London
Graham, E .... 1C Greenock
Gray, W N. .. 2C Greenock
Green, J E. .. 2C N.Shields
Hutchinson, R. 2C Dublin
Jaggard, F. G... 2C London
Killick, A .... 2C London
Kinloch, J. .... 2C Greenock
Langan, B .... 1C Liverpool
Lewis, R. E .. 2C Liverpool
M'Call, C. .... 2C Greenock
M'Callum, L .. 1C Liverpool
M'Intosh, A .. 1C Greenock
Morrison, R. W. 1C Greenock
Ormond, P. C. 2C Greenock
Radford, E. J... 2C N.Shields
Riddle, A. G .. 2C London
Robb, D....... 2C Greenock
Ross, R ...... 1C Liverpool
Spence, R. .... 2C N Shields
Tinn, G. T..... 1C N.Shields
Tulloch, L. .... 2C N.Shields
White, W. C... 2C London

October 23rd.

Austin, C. E. .. 2C Cardiff
Braidwood, T. 1C Liverpool
Brown, J....... 2C Liverpool
Burn, R. ...... 1C N.Shields
Caramalis, D... 2C Cardiff
Carnegie, J G 2C South'ton
Charlton, F. .. 2C N.Shields
Colpitte, C. .... 2C W. Hart'l
Davidson, H W. 2C Leith
Dich, R. C..... 1C London
Douglas, J .... 1C Leith
Eggleton, T .. 2C N Shields
English, F C. 2C W. Hart'l
Evans, R .... 2C Liverpool
Evans, S. W... 2C Liverpool
Evans, T....... 1C Cardiff
Fulford, R..... 1C South'ton
Greig, J ...... 1C Glasgow
Hall, T M..... 1C N.Shields
Hayman, S H. 2C Plymouth
Herbert, W J. 1C Cardiff
Hughes-Jones, W T A. 2C Cardiff
Jones, R. T. .. 2C Cardiff
Jones, W. L. .. 2C Cardiff
Kent, J. C. .... 2C Cardiff
Kerr, J. ...... 1C Glasgow
Lemmon, G G. 1C South'ton
Lewis, B ...... 2C Cardiff
Lithgow, O. .. 2C W. Hart'l
Lowe, H. G .. 2C South'ton
Luff, F ...... 2C London
M'Crinder, W M. 2C Glasgow
Marwick, T. .. 1C N Shields
Mason, J A .. 1C Cardiff
Mathieson, J. J 1C Leith
Matthew, D. .. 2C Glasgow
Michaelson, Y 2C South'ton
Milne, A....... 2C Glasgow
Mitchell, G H 1C Plymouth
Morley, F C .. 2C W Hart'l
Nairn, W. H .. 2C N.Shields
Owen, H J. .. 1C Liverpool
Pender, F. W 2C South'ton
Potter, R. F .. 2C South'ton
Putnam, P. .... 2C London
Quarrie, R H. 2C Liverpool
Richards, T. J 1C Cardiff
Roberts, W. H 1C Barrow
Sanderson, J .. 2C W Hart'l
Short, G S .... 2C Glasgow
Simpson, J .... 1C Glasgow
Storm, J ...... 1C London
Storm, J M .. 2C Cardiff
Story, R. ...... 2C W Hart'l
Stuart, C. .... 1C Liverpool
Terry, A .... 1C W. Hart'l
Todd, F. N. .. 2C Liverpool
Vincent, C. .... 2C Liverpool
Webb, F....... 2C Liverpool
Weston, T. .... 2C South'ton

The Marine Engineer

And Naval Architect.

LONDON, DECEMBER, 1909.

PROPELLING MACHINERY FOR WARSHIPS

THE history of the progressive development of the propelling machinery for warships over a considerable number of years is a subject that is always interesting to marine engineers, and when treated by such an authority as Engineer Vice-Admiral H. J. Oram, C.B., Engineer-in-chief of the Fleet, the subject has special interest. It was dealt with by this gentleman in an inaugural address given by him as President of the Junior Institution of Engineers, and is well worth the perusal of all those who take an intelligent interest in the advance of science in this particular direction. We do not propose to deal with all the subjects dealt with in the address, but desire to limit ourselves to one or two which appear to us to have special interest at the present moment. The result of reducing the weight and space occupied by propelling machinery has materially increased the revolutions per minute of the engines, with the necessity for special arrangements to maintain the proper lubrication of the various surfaces in which a high rubbing speed is set up. Reliable and satisfactory results have been obtained, and such lubrication has been widely adopted. As a testimony to its utility in reducing the liability to accident and in saving in friction of engine bearings, the author stated that on examining the main engines of a destroyer fitted with forced lubrication, after the engines had run 20,000 miles, it was found that the original tool marks on the white metal bearings were still visible. The results obtained with the main engines have been so satisfactory that forced lubrication has been provided for a great majority of the auxiliary engines, and with very satisfactory results. One of the difficulties, however, was the considerable amount of oil fed by the exhaust steam to the condensers, it having got into the cylinders, due to the splash lubrication on the piston rods, and as the oil finally got into the boilers and was a fruitful cause of over-heating and other similar troubles, this difficulty had to be overcome. Modifications of design, with superior glands fitted to the rods, together with improvements in the grease filters, have so minimised the detrimental features, that proper attention to the fittings provided, has rendered the possibility of objectionable conditions very rare and the subject has been reduced to one of no importance. As renewed attention has been given to the subject of superheating for modern work the author has been good enough to give the general record of the subject for fifty years back. It was in 1858 that an Admiralty Committee reported on the desirability of having superheaters fitted to the boilers of the Navy, and as a result of such report Admiralty boilers from 1863 to 1870 were always specified to be so fitted, but superheaters were abandoned after a brief period, in the new ships laid down, and did not reappear in the Navy till quite recently in one single instance. The difficulties of superheated steam in the earlier experiments consisted of the increased wear and tear of valves, pistons and cylinders due to the charring of the lubricant and the burning of the soft packings, resulting in excessive leakage of steam, especially in trunk engines. To minimise these troubles the amount of superheat was first reduced, and then it was proposed that the steam should be divided into two streams, one only of which was to be superheated, so that the subsequent mixture could be controlled. Salt water was used for boiler make-up feed, owing to this when the boilers primed, the salt was carried over to the superheaters, which caused corrosion and the rapid burning out of the tubes. In spite of these drawbacks it is generally conceded that under favourable conditions coal economy from 20 to 25 per cent. was obtained from superheating, but improvements in the construction of boilers for higher pressures and the introduction of multiple expansion engines produced greater economy, without the same objectionable conditions and thus superheaters fell into disuse. It was in 1904 that superheaters were again introduced into the service on a small scale, as six water-tube boilers out of twenty-one were installed on H.M.S. *Britannia*, a battleship of 18,000 I.H.P., were fitted with superheaters, and, after trials with superheat of 93° F., 61° F. and 30° F., it was found that, at the two higher degrees, "dragging" action occurred in the cylinders, and the general result of the trials led to the conclusion that, as then fitted, it was not advisable to work the engines with steam superheated beyond 30° F., and no marked economical result was achieved. Internal lubrication was not used on these trials in accordance with the established practice of the Admiralty, but if it had been used the author thinks it would have probably largely reduced the dragging action set up, but with the present means of feed water filtration the admission of such lubricant is objectionable. The address affords a useful purpose in pointing out what a large field of work lies still unexplored, and emphasizes the necessity for, and the usefulness of research to find solutions to problems which face the engineer in adapting machinery to the continually altering conditions due to healthy development of the better service of nature for the benefit of man.

WATER HAMMER IN STEAM PIPES

THE subject of water-hammer action in steam pipes was dealt with by Mr. Bishop M. King, in a paper read before the Institute of Marine Engineers a short time ago, and the treatment of the subject was presented in a somewhat novel form from that generally adopted. Engineers in charge of steam

installations, particularly those which work under the same conditions obtaining on board ship, in which ranges of steam pipes are situated in exposed positions and are subjected only to intermittent use, know full well the general effect of the water hammer and the often resultant unfortunate consequences of the same. The author points out that it has been suggested that the cause of water hammer in many cases may be attributed to water lying at the bottom of the pipe, and when steam is turned on it, it strikes the surface of the water and heaps it up into a wave. On the opposite side of the wave a partial vacuum exists, owing to the first part of the steam passing over the surface of the water and becoming condensed. Under these conditions, a wave of water exists having vacuum on one side and boiler pressure on the other, and the noise is produced by the wave striking the top of the pipe as it is impelled along by the steam. The author considers that it is not so much a difference of pressure as it is of velocity that is the cause of the trouble, but he thinks that it is quite arguable that the two are practically the same; however, they do not vary directly as velocity varies as the square root of the pressure. In treating the subject he starts with the dynamic law that momentum is unchanged after impact; for example, if two bodies come into contact, one being light and having a high velocity and the other comparatively heavy and at rest at the moment of impact, the sum of their masses will have a new velocity. These two factors being multiplied together will equal the momentum of the steam before impact. To illustrate his argument he gives the following example:—Supposing a $\frac{1}{2}$ lb. of steam mixes with 2 lbs. of water, the steam having a velocity of 200 ft. per second, then momentum before impact:

$= \frac{1}{2} \times 200 = 100$ and after impact:

$V\ (2 + \frac{1}{2}) = 100$ V = new velocity

$$V = \frac{100}{2\frac{1}{2}} = 40 \text{ ft. per sec.}$$

When the mixture of steam and water travels along the pipe of this new velocity of 40 feet per second, and encounters an obstruction, such as a bend in the pipe, a violent blow naturally results and the kinetic energy of the moving column is given up, when the bend of the pipe re-acts upon it, compelling it to change its line of motion, and the work thus done upon the pipe is sometimes shown by its fracture, although such pipe may have been initially tested with static pressure much above the ordinary working pressure. The author considers that when the impact takes place the pipe is extended to a fractional amount, and this extension, multiplied by the force of the blow and divided by two (because the force varies from maximum to zero), will be equal to the work done, and if the values of the force and the extension were known, he thinks that it would be found that the pipe was strong enough under normal conditions if the force was steadily applied, but it is the sudden application of the force which causes the trouble; in other words, it is the influence of time on the stress strain diagram. In looking at the matter from this light it is pointed out that if the work is done in a time which does not allow the material to extend through a distance which, multiplied by the force and divided by 2, equals the work done, for example, if only $\frac{1}{2}$ the extension is obtained, the stress on the pipe is doubled and it may be said that the maximum cohesive properties of the material are analagous to inertia and are unable to suddenly adapt themselves to new conditions, and before the maximum internal resistance can be put forth, cohesion has been destroyed. In the course of the discussion Mr. J. G. Hawthorn expressed his disagreement in this dynamic theory, as he failed to see how it was possible to get the wave suggested by the author, as the steam would simply pass over the surface of the water. He could understand that if a wall of water existed at a bend, when the steam came in contact with it at a high velocity, the stress produced would probably cause a fracture of the bend. In giving an illustration of this he referred to long straight lengths of winch-pipe laid so as to gravitate towards the aft end of the ship. When the steam is first turned on, it seemed to him that on some of the steam being condensed a partial vacuum is formed, and it is the water endeavouring to diffuse into that vacuum that produces a hammer action, anyhow as far as straight pipes are concerned. In order to prove this, first open the drain cocks, and when the steam is turned on, at first water will come out and then nothing further for a while, clearly showing that there is a vacuum in the pipe until you get the steam, and it is during the time that elapses before the steam flows that most of the cracking noise occurs, and it is very rarely that it happens during the time that the water is running out through the drain cocks. These two points of view present the matter in a distinctly interesting light and whether either one or the other may be right, wholly or partially, discussion on such an important matter is most desirable, as it cannot fail to be of great utility, even if it only results in the formulating of some system of arranging steam pipes, in order to obviate or reduce as far as possible the extremely objectionable conditions set up by the combined action of water and steam when brought into contact with each other.

SUPERHEATED STEAM.

THE paper read by Mr. White, at the Institute of Marine Engineers, on "Superheated Steam," deals with a question which has been a subject of controversy for very many years. In the days of the compound engines with 80 lbs. pressure the annular superheater was common. This style was effective and convenient, and the amount of deterioration, where properly looked after, was small. The introduction of the higher pressures was considered to be

effective without superheating, while the annular style was almost prohibitive on account of the weight which would be involved in pressures of 180 lbs. Many advocates of superheating have urged that, notwithstanding the increases in pressure, there still remained much water in the steam and many sources of condensation, thus reducing the efficiency. The nearer the steam as a motive power can be brought to the condition of a gas—more or less quite free from water—the more effective and more economical will the engine become. There is no doubt therefore that superheating is good, and the evident disadvantages in connection with its use should be frankly discussed and overcome by means which are not impossible of adoption.

THE "OLYMPIC" AND "TITANIC."—Steady progress is being made at Messrs. Harland & Wolff's yard, Belfast, with the construction of the new White Star liners *Olympic* and *Titanic*. The *Olympic* is more than half framed, and the after body is plated to the upper deck. Some idea of the immense work involved in the vessel's construction may be gained from the fact that the weight of the rivets in the double bottom alone is 270 tons, and that they number about half a million, the largest being $1\frac{1}{4}$ in. in diameter. The heaviest plate weighs $4\frac{1}{4}$ tons, and is 36 ft. long, while the rudder weighs 100 tons.

NAVAL AND MERCANTILE MARINE AND ENGINEERING EXHIBITION, OLYMPIA, SEPTEMBER, 1910.—Two Naval Exhibitions of note have been held in London during the last thirty years, the first in 1882, the Naval and Submarine Engineering Exhibition, which was visited by about a hundred thousand persons during the ten days it was open, the other nine years later at Chelsea, when some two-and-a-quarter million persons passed the turnstiles during the season. The advance in regard to Naval Architecture and Marine Engineering since the above dates has been most marked, and it is considered that the time is therefore ripe for another Exhibition of a similar character. Men-of-War now cost double to construct and arm that they did at that date; beyond their main engines they have often as many as sixty others for the various duties, and hydraulic, pneumatic, and electric power is utilised besides steam and internal combustion. The turbine has displaced or is worked in conjunction with the old-style reciprocating engine; a similar advance in comparison has also been made in the Mercantile Marine vessels of over thirty thousand tons and seventy thousand h.p., which are doing their journeys of thousands of miles with the regularity of an express train. In the designing, construction, equipment and working of our Fleets, the highest mechanical talent is employed, and the many important industries attached represent the employment of millions of the population. These industries, with the shipping and the auxiliary docks, harbours and other necessaries, represent a vast amount of the national wealth of the nation. This Exhibition will be open to all matters relating to the construction, outfit, equipment and repair of the Royal and Mercantile Marine, from the mining of the raw material, the metallurgical treatment, casting, forging, drilling, pressing and the immense variety of shop tools and appliances used in conjunction. In addition to Marine Work, the scope of the Exhibition will cover the whole field of Mechanical Engineering and the Metal Trades' Industries. The following proposed classification of Exhibits will convey some idea of the size and magnitude of the Exhibition:—Class A, Mining of Raw Materials; Class B, Metallurgy; Class C, Casting; Class D, Forging, Rolling and Pressing; Class E, Shop Tools and Appliances; Class F, Hydraulic and Pneumatic Plant; Class G, Electrical Work; Class H, Warming, Lighting, Sanitary Ventilating; Class J, Machinery for Treatment of Raw Material, Wood Working, Etc.; Class K, Fitments for Saloon Library, Music and Cabins; Class L, Scientific Instruments, Sextants, Compasses, Soundings, Etc.; Class M, Auxiliary Machinery; Class N, Stewards' and Dining Saloon Requirements; Class O, Kitchen and Cooking, Etc.; Class P, Provisions; Class R, Music, Band Instruments, Deck Games, Etc.; Class S, Deck, Harbour and Lighthouse Work and Salvage; Class T, River and Lake Navigation.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

Old Ships.

WHAT appears to be a sudden rush of sales to shipbreakers has befallen the principal shipping companies. As noted in these columns already, the P. & O. Company has just disposed of three famous mail steamers to Italian buyers, who are likely to find them fitted for no other destination than the scrap heap. Now the contemporary vessels of the Orient Line are finding their way to the same end. First we have the name ship, *Orient*, forerunner of the line. She was built at the Fairfield yard in 1879. She arrived at Plymouth on the 30th October and is not again to be employed by her owners. Her destination is, therefore, the sale room certain, and, probably, an Italian ship-breaking yard thereafter. Though two years younger than she, her famous sister the *Austral* was broken up some five years ago. The reason for this was that though she had a most extensive overhaul and refit after her sinking in Sydney harbour in the beginning of her career, the *Austral* never had her engines modernized. The *Orient*, on the other hand, had new boilers and her engines tripled in the year 1898, and was thus fitted to continue her career some years longer. During the Boer war the *Orient*—which was chartered by the Government quite at the beginning of hostilities—not only made many voyages to South Africa with troops, but had also several other interesting employments in the public service. In January, 1902, she was sent to St. Helena with a consignment of Boer prisoners, and on at least two occasions was sent to Australasia with consignments from the daughter nations.

Another vessel, also for many years employed in the Orient service, has just left London for an Italian port, where she is to be dismantled. This is the six-thousand-ton *Orova*, built in 1886 at Barrow for the Pacific Steam Navigation Company. By them she was employed in the maintenance of their part of the Orient service to Australia with the half-dozen vessels similarly engaged and taken over by the Royal Mail Company when they stepped into the shoes of the Pacific Steam in the Orient partnership. Since the Orient Company has assumed the full responsibility of their service the Royal Mail Company does not seem to have had suitable work for all these vessels, and so they are beginning to change hands again. The *Orotava*, however, is at present profitably employed in the season passenger service to that favourite winter resort of wealthy Americans, Bermuda.

But a far more important transfer is that of the *Etruria* of the Cunard Company, which has followed the fire-damaged *Lucania* into the hands of Messrs. T. W. Ward & Co., of Sheffield. She will probably, therefore, end her days on the beach at Morecambe Bay. The price at which she changed hands has been stated at £18,000, but this has been declared incorrect. Built at Fairfield in the year 1885, she was the younger sister of the *Umbria*, which has been spared for a little longer service, having been taken by her owners out of the sale list and appointed to take a sailing. The *Etruria* was a fine example of the good work for which Fairfield is noted. For though, of course, she made her record passages early in her career, she achieved her absolutely best passage in the year 1898, when she was already some thirteen years old. Her one serious accident was the breaking of her shaft in the Atlantic in February, 1902. The occasion just failed to be one of the examples of the immense value of Mr. Marconi's invention for safety at sea, for the Cunard Company had fitted the *Etruria* and the other mail steamers of their fleet with wireless telegraphic installations in October, 1901. On this voyage, which we are discussing, the *Etruria* sailed from New York to the eastward on the 22nd February, and on the 26th of the same month, at 5 p.m., being then in lat. 44°20 N., long. 41°40 W., the *Umbria* westward bound was in communication with her and received messages to the effect that all was well. The same evening, however, the *Etruria* lost her propeller. Wireless telegraphy was then in its infancy, and it proved impossible for her wireless operator to pick up the *Umbria* again. Fortunately, however, the Leyland Liner *William Cliff* came up and at daylight she commenced arrangements for towage. For additional safety the steamship *Ottawa* also stood by for some

time, and at 6 p.m. on the 9th March the disabled steamship was safely anchored in Fayal Roads, having been towed a distance of some 500 miles. The *Etruria's* passengers, with the exception of one or two ladies who preferred to remain in the *William Cliff*, were brought on to England by the Royal Mail steamship *Elbe*, and the *Etruria* herself made the homeward passage in tow of the well-known Liverpool tugs *Pathfinder* and *Blackcock*. For her services the *William Cliff* received the handsome award of £11,000, the amount at risk in the *Etruria* being fixed at £52,000 for the hull, and £166,077 for the cargo, including £80,000 specie.

The young blood now introduced on to the board of the Cunard Company has indeed made up its mind to make a clean sweep of the older tonnage, for it has been reported —since the announcement of the sale of the *Etruria*—that the *Aleppo*, *Saragossa* and *Cherbourg*, mentioned as for sale in the last issue of these notes, have now been disposed of. They also have gone to Mr. T. W. Ward, and will undoubtedly be broken up. I think that the Combine now has the distinction of running the oldest vessel in any important Atlantic service—the *Ottawa* being still employed by them in their Dominion service to the St. Lawrence. The *Ottawa* is, of course, the present name of the famous record breaker *Germanic*, built in 1875 for the White Star Line by Messrs. Harland & Wolff. She is one of the few vessels that of recent years have had entirely new machinery put into them, and that is probably the reason why she has been run in such a competitive service for a period long beyond that usual with vessels of her class.

In place of the three old Mediterranean steamers the Cunard Company has bought existing tonnage instead of placing orders with shipbuilders. Three steamers belonging to the Plate Steamship Company and registered at Rochester have been bought. They are the *Oro*, of 3353 tons gross register, built in 1900 at Middlesbrough by Sir Raylton Dixon & Co; the *Orono* of 2891 tons, built two years earlier, by the same firm of shipbuilders; and the *Oceano* also built by the same Middlesbrough firm. The last-named is of 2715 tons register and was constructed in 1896. It will be remembered that the vessels whose places they take were much smaller, as the *Saragossa*, the largest of the trio, was only of 2160 tons gross, whilst the *Cherbourg* was only 1614 tons. The price paid for the three new vessels is said to have been £52,000, and I presume the value of the ships sold will have been about £6000 to £7000 together, though a much larger figure has been quoted in the press. The Company has renamed the *Oro* the *Phrygia*, whilst the *Oceano* has been renamed *Lycia*, and to the *Orono* has been allotted the name of *Phracia*. They have already begun work for their new owners.

An Unusual Case

in the Admiralty was that which arose out of the disastrous collision off the Spurn in the North Sea between the steam trawler *Prome* of Grimsby and the sailing vessel *Gladys* of Bristol. The collision occurred 150 miles from land, when the trawler was engaged in getting up her nets. The barque seems to have run her down in clear weather and in broad daylight—the time being 9 a.m. The *Prome* seems to have been exhibiting the signals enjoined upon vessels engaged in such duties as hers by the regulations. But as Sir John Bigham pointed out in his judgment in the Admiralty suit, the *Gladys* making some eight or nine knots, was within 150 feet of her before those in charge of her navigation became aware of her existence. The evidence adduced at the trial showed that the master being on the poop and the barque down by the stern, it was impossible for him to see an object right ahead, and so though the *Prome* ought to have been in sight for an hour before the accident she was in fact never seen. It could hardly be urged that the *Gladys* was not to blame. But a defence was set up to the effect that the trawler was also in fault in that she did not use her engines to get out of the way. The learned President, however, refused to accept this plea, holding that the trawler was in the position of an anchored ship and that it was the clear duty, not only of steamers, but also of sailing vessels to give way to a trawler under such circumstances. He gave a reason for this view, holding that it would have been dangerous to start the engines under these conditions, as doing so would probably have fouled the trawl and disabled the propeller. As it was the *Gladys* struck the trawler so severe a blow that she sank almost immediately and all her crew, consisting of nine hands, were lost. The *Gladys* having been found alone to blame, her owners are, of course, bound to make good the money-damage sustained. But this did not end the matter. A prosecution was instituted by the Board of Trade against the master of the *Gladys* for neglecting to do a lawful and proper act requisite to be done by him for the preservation of his ship from immediate loss, destruction or damage by omitting to place a look out in such a position to see at least one point on either side the bow of his vessel—whereby the collision with this trawler, the *Prome*, followed, with its attendant loss of life. The prosecution was adjourned pending a possible appeal by the owners in the Civil Suit, and has since been dismissed.

Record to the River Plate.

The Pacific Steam Navigation Company's fine steamship *Oroma*, added to their fleet last year, has just lowered the record from Liverpool to the River Plate. She was but twenty-one days on her voyage between the Mersey and Monte Video, calling at nine intermediate ports and beating her schedule time by two whole days. It is claimed that this passage is not only a record for Liverpool liners, but, allowing for detentions and calls, is a record for all British steamers.

The Thames Steamboats.

After much beating the big drum a sum sufficient to warrant the new company in starting a curtailed service with two of its fourteen steamers has been subscribed, the termini of the service being London and Greenwich. But the support given to the venture was weak in the extreme, and after a brief trial the daily sailings have been discontinued and at present the vessels only ply on Saturdays and Sundays, when they maintain a half hourly service. This, of course, is a bad beginning. But, though it is proof enough that the steamers are not wanted for business purposes, it by no means follows that because people won't go on the Thames for business in November there may not be a very good demand for the steamers in the summer months for excursion traffic. One would hardly, for example, expect to gauge the volume of traffic to be anticipated between Oxford and Kingston in July and August by the number of people seeking for Thames launches at Maidenhead in the months of storm, snow and flood.

The Union Castle Company

have made an important extension of their services. Hitherto the port of Beira has been their northern terminus on the East African Coast. But they now give notice that, commencing with the sailing of their favourite twin-screw passenger and cargo steamship *Dunluce Castle*, which is appointed to leave Southampton on the 1st January, 1910, there will be a monthly despatch to Chinde, Mozambique, Zanzibar and intermediate ports to Mombasa. Complete arrangements for taking cargo from the Continent have been made and facilities will be given to passengers who desire to do so to exchange into the Royal Mail steamships of the line at Durban. Altogether this new departure should be a great point in favour of British trade in our keen competition with Germany on the East Coast of Africa.

The Union Castle Company have also received an addition to their fleet the new 13,000 ton mail steamer *Balmoral Castle* having been launched on the 13th November by the Fairfield Shipbuilding Company. The sister ship building by Messrs. Harland & Wolff is to be named *Edinburgh Castle*, and is shortly to be ready to take to the water.

MARINE ENGINES AND SUPERHEATED STEAM.*

By Mr. A. F. WHITE, M.I.Mar.E.

EARLY last year the author was asked by a firm of shipowners to make a report to them upon the progress that had been made in connection with the use of superheated steam on board ship, and what had been the actual results arrived at, especially in such cases where highly superheated steam had been in use. It is partly the results of this investigation which he now proposes to place before the Institution, together with some general information collected during the time that this subject has had special interest for him.

It is now over fifty years since a means was sought to prevent the losses due to condensation in the cylinders, as this loss constitutes an evil which is common to all types of engines using saturated steam, and so attention was thus turned to the advantages to be obtained by hotter and dryer steam than that given off at the boiler. Although the British marine engineer has lagged somewhat behind engineers on the Continent in the use of highly superheated steam, that is to say, steam having a temperature of 180° F. above that due to its pressure, it must not be forgotten that in the practical adoption of superheated steam he may still claim to be the pioneer in its application to marine engines. James Watt recognised the real nature of cylinder condensation, and tried to eliminate the trouble by the use of steam jackets, a method which has remained in use up to recent times, although it has long been known that the losses in question could be more effectually reduced, and, under certain circumstances, entirely avoided by the use of superheated steam. Since the year 1830, engineers have made various attempts to employ superheating, but the subject does not appear to have been scientifically treated until 1857, when Hirn took the matter up thoroughly, and investigated it by tests on actual engines. At that period, owing to the low range of temperature and range of expansion, it was found that the degree of superheat adopted by Hirn was not high enough to be of much commercial value, and was only instrumental in reducing condensation to a very slight extent. It has since been found that an average temperature of 550° F. must be maintained in the H.P. valve chest in order to ensure the superheated steam being free from intermixed wet or saturated portions, coal and water consumption being considerably increased whenever the temperature falls to any appreciable extent below that figure. This partly accounts for the failure in early times to realize the economy from superheated steam which is now common in every-day practice, it not being then practical to either obtain or use the temperature necessary for high economies. A practical apparatus, capable of producing a high degree of superheat, did not then exist, and what was even a greater drawback, the best lubricant of that day could not resist the temperature inseparable from the use of a high degree of superheat, and trouble was experienced with valves and packing. Consequently superheating was abandoned in favour of compounding, introduced about that time, which, accompanied by the employment of relatively high steam pressures, and reduced range of temperature, offered another, though a far less effective, method of reducing the amount of initial condensation in the cylinders. But when, more recently, owing to the development of compounding from double to multiple expansion, the limit of efficiency with saturated steam appeared to be reached, engineers once more turned their attention to superheating.

Without going deeply into the question of the action of heat in the cylinders, as this has been fully treated by many able authorities, it may not be out of place briefly to refer to some of the physical properties of steam. Saturated steam of a given pressure has a certain known temperature. If heat be added to the steam while it is still in contact with water (for instance, in the boiler), more water will be evaporated, and the quantity of steam will be thus increased, but the saturation temperature will remain the same as long as the pressure is constant. On the other hand, if heat be taken from it by cooling or by the performance of useful work during expansion, a part of the steam will be condensed.

As no boiler produces perfectly dry steam, a certain amount of water is carried to the engine when saturated steam is used, and a further quantity is produced by condensation in the cylinders and receivers. As water, it is useless as a working fluid, and the heat already expended upon it is a dead loss. A natural desire arises, therefore, to add enough heat in the initial stage to obviate this waste. Superheated steam can only be produced by heating saturated steam in separate apparatus away from the water in the boiler. If heat be added to the steam when it is no longer in contact with the water, *i.e.*, in the superheater, its temperature will be raised above that due to its pressure, in other words, it will be superheated, and heat can then be extracted from it without causing condensation: such steam may be cooled on its way from the boiler, or when in the cylinder by the same amount that it has been superheated, and condensation will not be reached so long as the temperature of the steam is sensibly higher than that of saturated steam at the same pressure, in which case it will remain a pure and simple gas, and act as such in the cylinders. In other words, if saturated steam

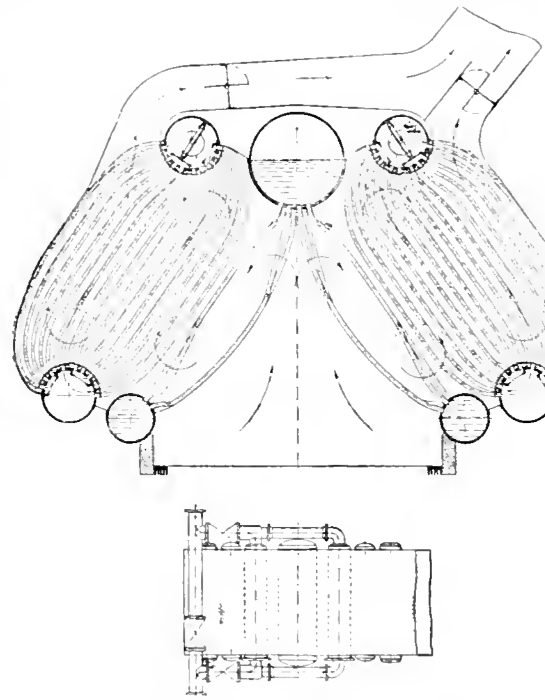


Fig. 1.—Separately fired Superheater.

from the boilers is passed through the tubes of a superheater, the water contained in the steam is evaporated out of it, with the following results:—

1. Rise of temperature.
2. Increase of volume if pressure is kept constant; or increase of pressure if volume is kept constant.

The chief advantage to be gained by the use of superheated steam lies in the fact that cylinder condensation is practically eliminated, and that owing to the low thermal conductivity of superheated steam it does not so readily drop in temperature when exposed to cooled surfaces. Highly superheated steam in comparison with saturated steam is a bad conductor of heat. This property, which, on the one hand, is of great value in reducing the loss from condensation in the cylinders, is, on the other hand an obstacle to the free transmission of heat to the steam in the superheater, and calls for special consideration in the design of the latter. Superheaters may be divided broadly into two classes.

1. Those in which the steam is superheated by the gases generated in the boiler furnace.
2. Those forming a separate unit having their own furnace.

The general design of a superheater of the first class naturally depends upon the type of boiler to which it is to be applied. Broadly speaking, there are three positions in which the superheater may be placed. It may be in the combustion chamber, an ideal place, but impracticable. It may be i

* Read before the Institute of Marine Engineers on November 15th, 1909.

the uptake, so as to absorb the heat that is left in the gases after passing through the generator, or it may be somewhere between these two extremes. As already pointed out, the first position may be discarded owing to the difficulty in obtaining materials which, under pressure, will withstand the prevailing temperature. The second position with an efficient boiler gives only a moderate degree of superheat, resulting in a relatively low economy. It would appear, therefore, that the superheater ought to be in such a position that it will come in contact with gases from the furnace having a temperature of not less than 1,000° F. If the superheater is applied to ordinary Scotch boilers, it ought to conform to the following conditions :—

1. It should not necessitate much alteration in boiler design.
2. It must be efficient under varying conditions of temperature.
3. It should be easy of removal should such become necessary.
4. It should be easily cleaned.
5. It should be easy to remove, renew or repair any tube without blowing off the steam in the boiler, or shutting off the boiler for any serious length of time.
6. It should be easy to locate any leak.
7. It should be placed where least liable to external corrosion.
8. The superheater tubes should be parallel with the flow of the furnace gases.
9. Only solid drawn steel tubes should be used.

Upon investigation it would appear that with superheaters fitted in the uptake the gain in economy in coal consumption amounts to about $7\frac{1}{2}$ per cent., and it is doubtful whether this

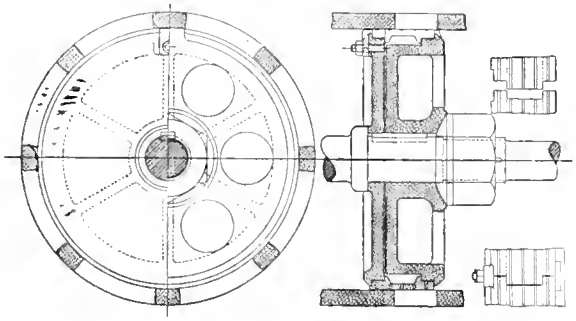


Fig. 2.—Piston Valve with Balanced Split-Ring

small gain is sufficient to pay interest on first cost and maintenance charges, especially in the case of vessels on short voyages, or where the length of time at sea is small in proportion to the time spent in port. In the case of superheaters in contact with higher temperature flue gases, giving a superheat of about 250° F., it is found that the economy with triple-expansion engines averages 15 per cent. It may therefore be said that a low degree of superheat (say 500° F. steam temperature at the engine with boiler pressure 200 lb. per in.) while effecting a drying in the steam and a certain economy in consumption, is, commercially speaking, hardly worth considering. Owing to the relatively much greater economy to be obtained from a high degree of superheat, say a steam temperature of 620° F. at the engine, giving, as already stated, an economy in coal consumption of 15 per cent., it would appear that a form of superheater giving this temperature is the one having the greatest commercial advantages.

Although flame tube superheaters have been continuously in use on board ship since 1898 and 1899, the longest period that the author has had the personal opportunity of investigating has been on ships where the vessels have been using highly superheated steam for over two years, during which time no repairs have been necessary to the superheater nor have any repairs been required to the high-pressure valves more than is generally the case where ordinary saturated steam is employed. With regard to the life of the superheater tubes exposed to high temperature, such as is experienced with superheaters of what may be termed the "flame type," it may be said that in the case of a vessel continually in service the average duration is about eight to ten years.

In locomotives where the coal burnt per square foot of grate is about three-and-half to four times more than in mercantile marine practice, where the draught is much greater, and the temperature of the gases meeting the superheater tubes is nearly double the temperature of what would be experienced in tubes of a marine boiler at the same distance from the fire box or combustion chamber, the superheater tubes last as long

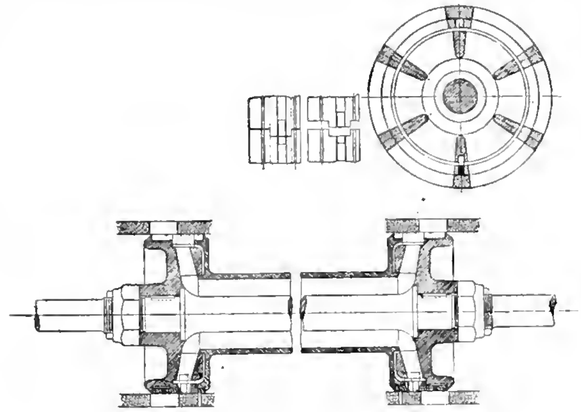


Fig. 3.—Piston Valve with Trick Channel

as the boiler tubes. Even supposing the superheater tube ends wear out in five years, the cost of repairing them is such a small matter as compared with the coal economy, that it makes a very small reduction in the nett saving. The life of the tubes in uptake superheaters may be said to depend on the original thickness of tubes used and the care taken of them to prevent outside corrosion.

On the question of fluctuation of steam temperature, it is found in practice that this is not so great as what at first sight seems likely, the steam generated and used being in proportion to the amount the fires are forced. The only time that the

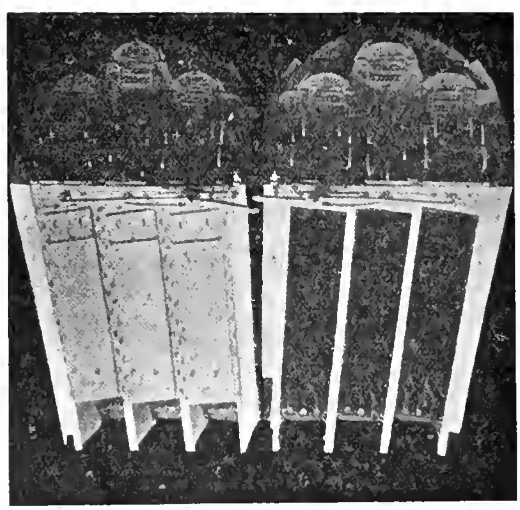


Fig. 4

temperature rises above the normal is when the engines are suddenly stopped. It is then found that the steam temperature in the superheater tubes rises about 50° F., but as the amount of steam at this increased temperature is only that contained in the superheater tubes, it is used up after the first few turns of the engines, and has not time to communicate its temperature to the valves and cylinder walls. In such cases where the auxiliary engines use superheated steam, this helps largely to keep down the temperature, which is easily reduced by slightly opening the fire doors after the ashpit dampers are closed. Where superheated steam is used, temperature and pressure are rightly considered of equal importance, and observation of the temperature gauges enables the engineer in the engine-room to know exactly the prevailing conditions of any boiler, the state of its fires, etc.

The illustration, Fig. 1, shows a form of separately fired superheater suitable for large naval vessels. As will be seen by referring to the drawing, water tubes are placed in direct

contact with the fire, forming steam-generating tubes, and may be considered as part of the boiler installation. The first heat of the fire is taken on these tubes, and the gases are afterwards conveyed by a circuitous route over a series of superheater tubes through which the steam passes. By an alteration in the disposition of the superheater tubes on either side of the fire and a suitably designed arrangement of dampers, a superheater of this type can be made to produce

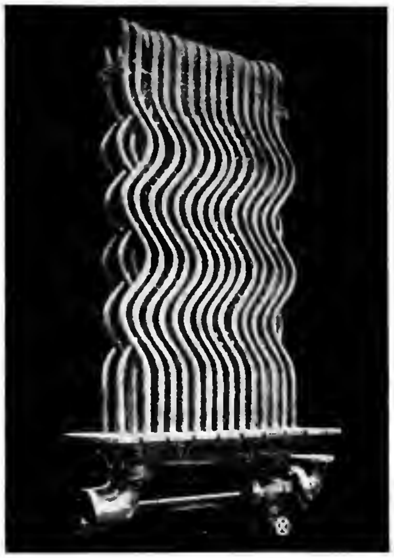


Fig. 5.

a fixed temperature of steam under very varying conditions of working.

Experiments made on the effect of superheat and the consumption of steam in turbines has proved that with a superheat about 216° F. a reduction in consumption in steam as compared with saturated steam amounts to as much as 21 per cent. In considering the economy in coal consumption, allowance should be made for the amount of coal burnt in the superheater, which by experiments has been shown to be about 11 per cent. with a superheater efficiency of 62 per cent.; leaving a nett gain in economy of coal due to superheating of 9 per cent. For a 75 per cent. efficiency in the superheater, this figure may rise to 11-12 per cent. Reference need only be made to the good economy obtained by the use of superheated steam working in connection with

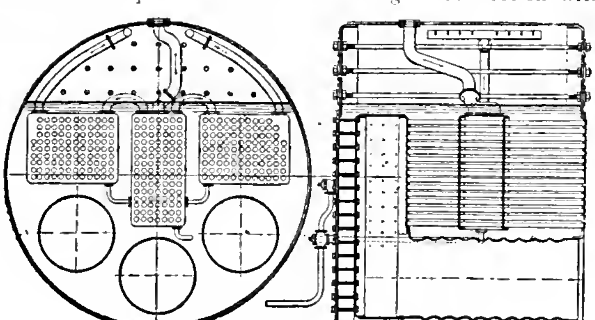


Fig. 6.—The Pielock Superheater.

turbines on land power installations, to prove the necessity there exists for obtaining the same economy on board ship. This economy is of such a very pronounced nature that it must in time be recognised and adopted in general marine practice so long as it can be proved that it is not attended by increased possibilities of a breakdown. Turbines of the impulse type may be said to be more adaptable for high temperatures than those of the reaction type, due to the large blade clearances and to the small effect of expansion. As the friction of steam across the surface of the blades somewhat seriously affects the efficiency of the turbine, it is obvious that water in the steam will produce a similar result, so that the frictional resistance and wear set up by saturated steam will be considerably reduced by the use of superheated steam.

With regard to the design of machinery using superheated steam, the following conditions should be observed:—

1. Copper or brass should not be used for pipes or valves in contact with highly superheated steam.

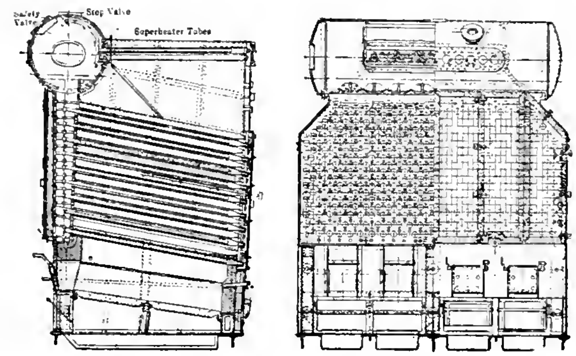
2. Superheated steam pipes should have special arrangements for free expansion, bends in the pipes being generally preferred to straight lengths and stuffing boxes, owing to the fact that with high temperatures the material used in packing and stuffing boxes may deteriorate and prevent free movement of the pipes. Special attention should be given to the staying.

3. Cylinder castings should be designed with a view to withstand high ranges of temperature, and allowance made for free expansion in all directions.

4. A form of valve to the H.P. cylinder not requiring lubrication should be aimed at.

5. The packing in the H.P. rod should be metallic.

6. Only the very best hydro-carbon oils procurable should be used, the flash point of which should not be less than 700° F.

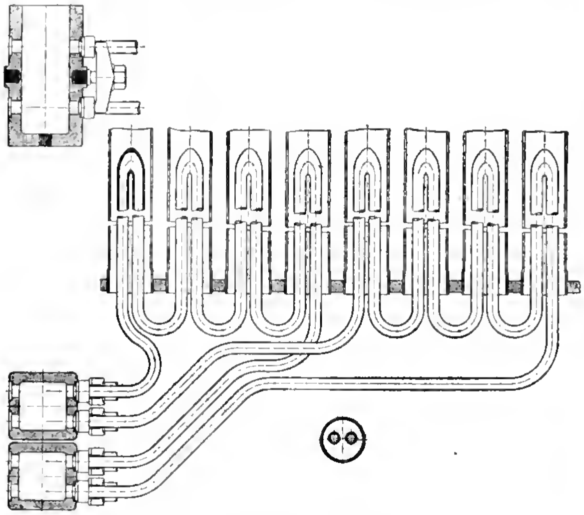


The Dürr Superheater.

7. Efficient means should be provided to prevent oil passing into the boilers.

Although excellent results have been obtained with piston valves with solid rings, such as are usually manufactured by marine engine builders, a desire has been expressed for a form of valve which, while suited to the requirements of superheated steam, would yet not necessitate such accuracy in the fitting of the rings as that required in the case of the solid ring type. The valve as illustrated (Fig. 2) has therefore been designed with a split ring and has been found to be very satisfactory. Experience has proved that narrow rings are not to be recommended for use with superheated steam, and that it is wise to make rings rather wider than is the usual practice with saturated steam. Wider rings, however, present another difficulty, in so much that they are forced with great pressure against the liner, and excessive wear takes place. On the other hand, during compression, they are unable to withstand the excessive pressure on the outer surface, and are forced inwards, thus causing leakage. In the type of valve illustrated, the advantages of the wide rings are obtained, but they are so constructed as to overcome the aforesaid drawbacks. This result has been achieved by providing several steam-tight spaces on the inside of each ring, which communicate with the steam port by means of radial holes about $\frac{3}{16}$ in. diameter arranged circumferentially round the ring. This ensures the pressure on both sides of the ring being equal, and the ring is only pressed against the liner by its own tension, which is sufficient to keep it steam tight. In order to secure a good fit between the valve ends and the ring sides, and to avoid jamming the ring between the two, the valve end is made with a certain amount of elasticity, and is screwed up against the valve body in the centre only, leaving the outer edges to be pressed up by the steam. The steam pressure of the cover gives the ring sufficient freedom for expansion. During exhaust, however, the ring is held in position by the cover, till re-admission takes place. Excessive outward pressure of the ring against the liner and, consequently, excessive friction are thus prevented,

although at some point of the stroke a perfect balance between the pressure on both sides of the ring may not occur instantly. The resistance to motion of this type of piston valve is very small, and the wear of the rings is almost infinitesimal. As compared with the solid ring type of valve, this modified type has the advantage of remaining absolutely steam-tight so long as there is any elasticity in the rings. The split or cut in the rings must always be placed opposite the broad bridge of the



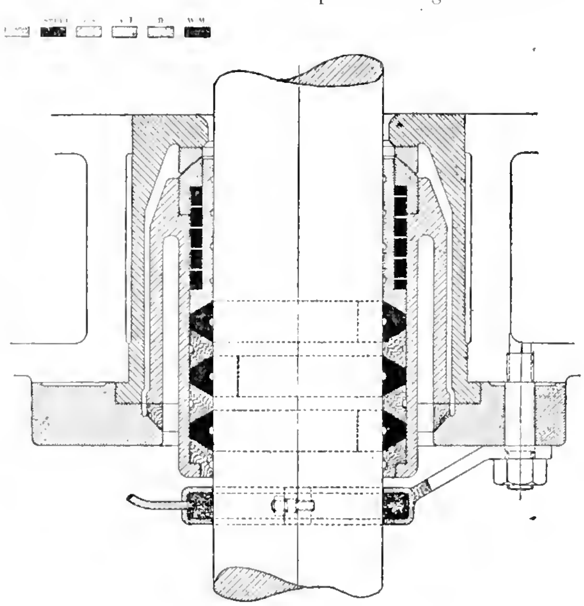
The Schmidt Superheater as fitted in the tubes of Scotch Boilers

liner, so as to prevent leakage through the cut. The cut in the ring is protected on the outside by a cover, which is fixed respectively to the valve body and to the valve end or cover. The screws holding the split cover prevent the rings from turning. In cases where the split covers are cast on, special set screws must be provided for this purpose. A later form of this valve has been made with a trick channel (Fig. 3), the object aimed at being the same as the trick channel in the slide valve type, *i.e.*, to give double admission, and thus allow of a smaller valve being used for high piston speeds.

With regard to pistons, it has been found that the ordinary Ramsbottom rings, as generally used in marine practice, give the best results. It should not, however, be forgotten that with high superheat, wherever there is a sliding surface, lubrication is essential. In designing valves and pistons, therefore, it is necessary to reduce as much as possible the friction due to the weight of the moving parts. It is thus absolutely necessary that the body of the piston should not touch the sides of the cylinders, so that in the case of large high-pressure cylinders (say over 24 in.) it is advisable to fit a tail rod, to ensure the piston being accurately guided throughout the whole length of its stroke.

Where trouble has been caused by piston rings breaking this may in nearly all cases be attributed to the decomposition of inferior oils, leaving a deposit on the cylinder walls and rings, which has prevented the rings having free movement. Slide valves on the I.P. cylinder have been known to give trouble where there has been much leakage of high temperature steam past the H.P. valve. However much care is taken in reducing by correct design the friction due to the pressure of the piston valve springs, it is absolutely necessary with high temperature of steam, to provide for special means of lubrication. This can be easily effected in a variety of ways, and the difficulty which confronts the marine engineer is not the lubrication of the parts so much as the extraction of the oil necessary for this purpose. To prevent this oil passing through the feed water into the boilers it is necessary to have special arrangements for trapping it. Filters on the delivery side of the pumps have been found to be useless for this purpose, indeed it might be said they are of very little value whether oil is used in the cylinders or not, as in the author's experience it is an extremely difficult matter to design a filter on the pressure side of the pumps with sufficient area to prevent it being quickly clogged. It may therefore be taken as a *sine qua non* that the filters be on the suction side of the pumps, and that special attention be given to see that they are kept in order. One of the simplest forms which this filter takes is an arrangement of cocoanut matting with coke layers between each pair of mats. The size of these filters varies according to the H.P., but in an ordinary tramp steamer of about 1200 I.H.P., six mats would be employed, each about 24 in. by 15 in. These mats are laid one above another with 4 in. of coke between each pair of mats. After every three or four days' steaming, the mats are taken out, washed in hot soda water, used again, and the coke renewed. In some cases sponges are used instead of coke. Any small quantity of oil which passes these filters and gets into the boilers is easily dealt with by the use of soda or zinkara, which is much less deteriorating to an engine using highly superheated steam than is the case where saturated steam is employed. Should priming occur, the water carried over with the steam becomes evaporated in the superheater.

It is not easy to ascertain with any degree of accuracy the number of vessels now using superheated steam, but so far as we can learn there are now afloat about 350 vessels of all sizes, from river and lake steamers up to naval cruisers equipped with superheaters. Of these, Germany takes the first place in numbers, having fitted out about 274 vessels, 188 of which are for canals, lakes, rivers and coasting service, eighty-one sea-going steamers, and five vessels for the Imperial Navy. Britain has about forty vessels using superheated steam, including four cruisers of H.M. Navy. America can be credited with twenty, of which eight are naval vessels; and France about ten merchant ships. Taking the countries



Piston Rod Packing.

in order named, it should be said that the steamers ascribed to Germany include the vessels belonging to that country and those owned in Switzerland, Italy, Austria, Hungary, Russia and Holland; most of these ships are fitted with the Schmidt type of superheater, and are worked on Dr. Schmidt's system of high superheat.

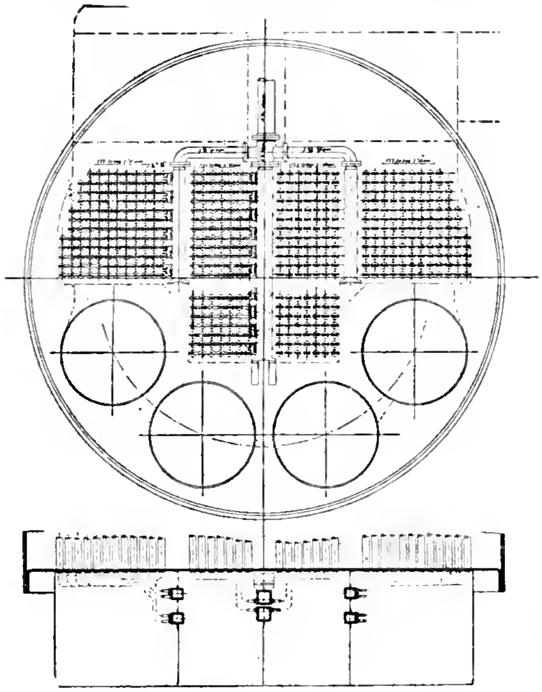
The first marine boilers fitted with this form of superheater were built in 1898 by Messrs. Sulzer Bros., of Winterthur, for vessels plying on the Swiss lakes. Owing to the very high cost of coal in this district, the advantage of superheating was a matter of great importance to the owners of these vessels. As a result of their success, other ships trading on the Italian lakes the rivers Oder, Danube, Volga, etc., were similarly equipped; the H.P. of these steamers ranges from 100 up to 1000, the smaller river steamers from 130 to 800, and the Rhine steamers which are from 1000 to 1350 H.P.

Amongst the ocean-going vessels fitted are eleven ships belonging to the Oldenburg Portuguese Steamship Company, and nine vessels belonging to the Argo Steamship Company, these steamers having engines of 900-1200 H.P. Other companies adopting Schmidt superheaters may be mentioned:

The Hansa Company, North German Lloyd, Compagnie Générale Transatlantique, and Compagnie des Chargeurs Réunis, Robt. Sloman, junr., Hamburg.

The warships include the cruiser *Dresden, Mainz, Cöln. Kolberg*, of 26 000 average H.P. each, and the *Ulan*, a steam tender of 1600 H.P.

258 ships are now equipped with superheaters working on



Four-Furnace Boiler with Schmidt Superheater.

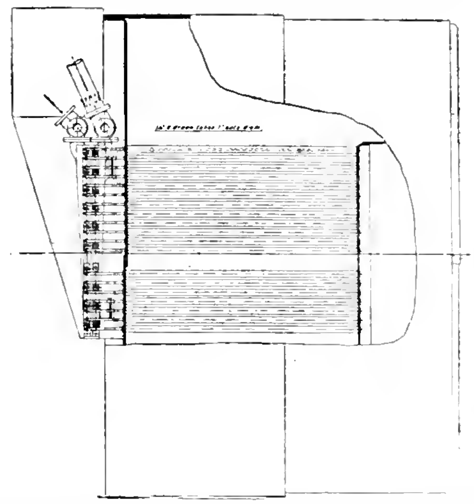
the Schmidt system (including those ships now being fitted), having an aggregate H.P. of 250,000, the superheaters being in nearly every case applied to the standard Scotch or cylindrical type of boiler, either in the boiler tubes or uptakes, some few having directly fired superheaters, and other special designs. This system has been applied to vessels fitted with both compound and triple-expansion engines. With compound paddle engines and superheated steam having a temperature of about 660° F. the fuel economy is about 30 per cent. as compared with the same type of engines using saturated steam, and about 15 per cent. as compared with triple-expansion engines using saturated steam, that is to say, in the case of slow-running paddle engines ordinary compound engines using superheated steam are 15 per cent. more economical as compared with similar vessels having triple-expansion engines using saturated steam.

The twenty steamers belonging to the two companies first named, with triple-expansion engines and superheaters fitted in the boiler tubes, have, in service, realized an economy of 15-20 per cent., and in one or two cases where the vessels' boilers previous to fitting the superheaters had been forced, the economy realized has been more than this.

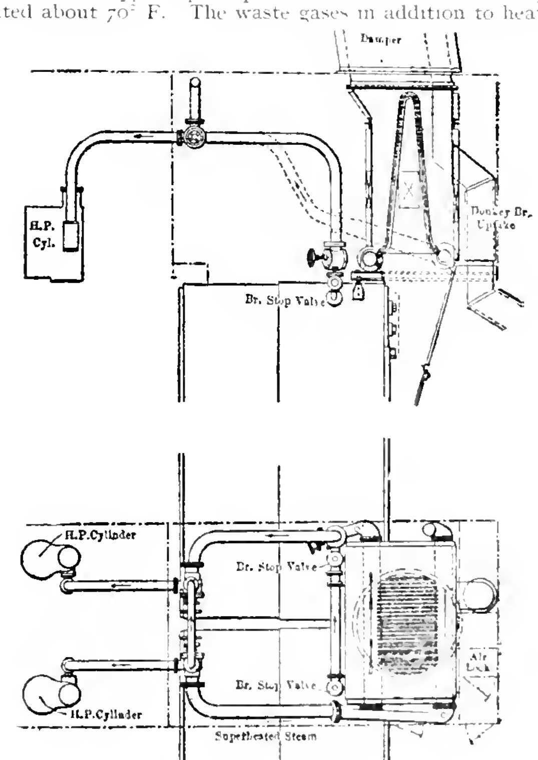
The steam pressure used in these ships is from 185-200 lb. per sq. in., and the average temperature of the superheated steam is 608-660° F. In several cases the original piston valves, such as those fitted in the engines when new, were retained, after superheaters were fitted, and appear to work very satisfactorily under the altered conditions. In the case of engines having slide valves, however, it was found that a steam temperature of 500° F. could not be exceeded, owing to the difficulty in effectively lubricating the valve face. When slide valves are used, the oil is forced on to the face of the valve mechanically, and in the case of piston valves the oil is mechanically forced into and atomized in the centre of the main steam pipes and carried by the steam into the valve chest and cylinders.

After a number of successful trials on ships of the mercantile marine, the German Admiralty have made some experiments on rather a large scale in the use of the separately fired superheater. The first ship fitted was that of the cruiser *Dresden*, with Parsons turbines, and the writer understands that on trial very satisfactory results were obtained, and the ship is now in commission. Separate fired superheaters have also been fitted on the German cruiser *Mainz* with Curtis turbines, but no official informaton has yet been given out with regard to the results obtained. It is stated, however, that the intention of the German authorities is to use superheated steam for further ships of the cruiser and battleship type.

In this country the first superheating installations in recent



years were made by the Central Marine Engine Works at West Hartlepool, in the year 1891, but since that time this Company has fitted many other vessels with superheaters of the type illustrated in Figs. 4, 5. The first two vessels having superheaters of this type were completed about 1900, and have since been succeeded by other vessels having quadruple-expansion five-crank engines. In these vessels the working pressure of the boilers is 255 lb. per square inch, and the steam superheated about 70° F. The waste gases in addition to heating



The Watkinson Superheater

the steam are utilized for heating the air entering the furnaces. As these vessels have engines of a very special design it is difficult to say exactly what is the economy due to the superheater alone, but it is the opinion of the author that with a

simple form of engines and by use of a higher superheat more economical results could have been obtained. Messrs. Thos. Wilson Sons & Co. in 1900 fitted the first of their vessels with a superheater from designs of their own, and although only a small economy has been obtained, owing to the relatively low superheat, it has been sufficient to induce this firm to use superheated steam in fifteen vessels of their fleet.

The type of superheater is that of the usual uptake construction, utilizing the waste heat from the escaping gases. Here again the steam temperature obtainable ranges from 500° F. to 520° F., and it has been found that there is a distinct loss directly the temperature falls below 500°F. Owing to ineffective lubrication some slight difficulties were at first experienced with the piston rings and valves, but these have since been overcome, and so far as the author has been able to learn owners of these vessels are very satisfied with the results obtained. Amongst other shipowners in this country who have vessels fitted with superheaters in the uptake are the Great Eastern Railway Company, the Allan Line, and the Hall Line, but no data has been obtained regarding the performance of any of these vessels. The British Admiralty have made some use of superheated steam in recent years, but as the temperature employed was so low the results are not of sufficient interest to refer to in detail.

In France, the Compagnie Générale Transatlantique in 1906 fitted their vessel *La Rance* with Pielock superheaters (Fig. 6), the engines having the Lentz valve gear with Poppet valves. Comparative trials between this vessel and a sister ship *Garonne*, the latter having the same sized engines, but with slide valves and no superheaters, showed that the use of superheated steam resulted in a very large reduction in coal consumption. This company has since fitted three other ships with Pielock superheaters, and has recently decided to fit *La Garonne* with the Schmidt superheater. In America, one of the first vessels fitted with the uptake type of superheater was the *J. C. Wallace*, and as results were found to be so satisfactory, two other ships had superheaters applied. The saving in coal consumption in these vessels is said to be 16 per cent. in favour of superheated steam.

The Foster type of superheater was fitted in the s.s. *Brazos*, this vessel having quadruple-expansion four-crank engines of 7000 H.P. and eight single-ended Scotch boilers. The ratio of superheater surface to heating surface of the boiler is as $4\frac{1}{2}$ to 1. The boilers work under Howden's system of forced draught. Although only a steam temperature of 460° is obtained the consumption of coal does not exceed $1\frac{1}{4}$ lb. per I.H.P. per hour. As the result of some trials carried out by the U.S. Navy Department on one of the lake steamers fitted with quadruple-expansion engines, it was found that an economy of 14 per cent. to 15 per cent. in coal consumption was effected by superheating. Four of the eight boilers in the U.S.A. *Indiana* are fitted with superheaters, and owing to their success other warships have since been using superheated steam, but the results of their trials have not been published. There are probably several other vessels using superheated steam besides those mentioned, but those referred to afford very striking evidence of the practical success of superheating as applied to latter-day marine practice.

There is really only one practical obstacle against the general adoption of superheated steam of high temperature in reciprocating engines, and that is connected with the use of oil. As already stated, lubrication of the working parts presents no difficulties, and if proper lubrication is provided and special attention paid to design of stuffing boxes, valves, pistons, it may be said that no troubles whatever arise with reciprocating engines using steam having a temperature of 600°-620° F. To eliminate this oil from the feed water, and to prevent its passage to the boiler is, in the mind of the author, the only difficulty which presents itself against the more general adoption of superheated steam. This difficulty has up to the present been overcome in all the ships visited, by means of efficient filters, and no trouble has been reported owing to oil in the boilers. The economical production of highly superheated steam may now be said to present no difficulties, and its use enables the shipowner to make such a substantial reduction in the cost of propulsion that it becomes the duty of the marine engineer to avail himself of the great advantages which it offers in engines of suitable design. Many experiments are being carried out on these lines at present, and the results will probably lead to the general adoption of superheated steam in marine practice.

PARAGRAPHS.

Shipbuilding Returns for 1909.—We shall publish in our January issue The Shipbuilding Returns of the World, giving details of the vessels launched during 1909. This has been the special feature of our January number for many years past. The number is a double one, but is the same price. It has a big circulation, and is specially kept for reference.

A Bucket Dredger for China.—What is probably one of the smallest and most compact bucket dredgers in the world has just been shipped to China by Messrs. James Pollock, Sons & Co., Ltd., of 3, Lloyd's Avenue, London, E.C. The surprising fact is that although the craft is only 40 feet in length overall, she carries a couple of dozen buckets, each of which has a capacity of one cubic foot, guided on a centre ladder by an oil engine of 11 B.H.P., constructed to burn cheap oil. The whole is so simply arranged that the dredger can easily be operated by two or three Chinamen. A large cooling tank, six winches, hoisting crane, and upper gantry, etc., make the craft a very complete little vessel. The dredger, which only draws in working trim about two feet of water, is designed to dredge in its flotation, but by adjusting the ladder, it can work down to a depth of eight to ten feet. Notwithstanding that she is to be shipped aboard in plates and angles, a complete dredger trial was obtained in the builder's yard, on blocks. The buckets were filled and tipped and all gear and machinery worked without the slightest trouble, and gave great satisfaction to all concerned. The craft was taken to pieces in the shipyard, and shipped on board the Japanese Liner *Kasami Maru* for Hong Kong. At the latter port she will be transhipped to her destination and put together to dredge the small waterways that she has been built for.

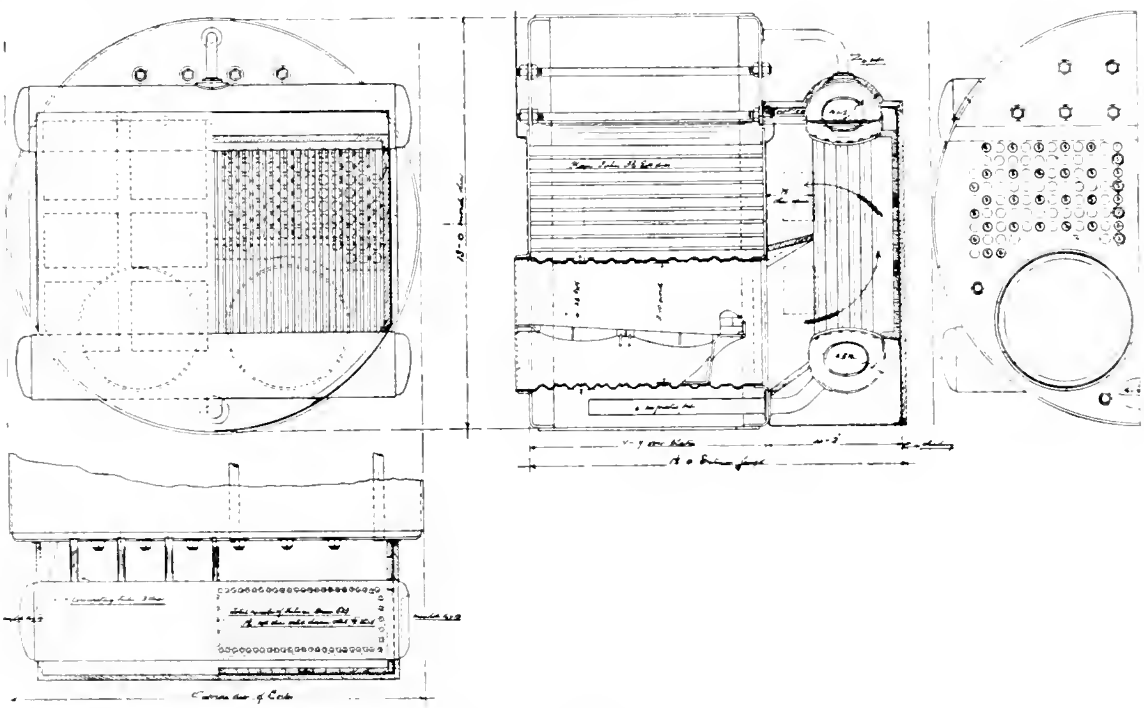
Lloyd's Register of Shipping.—The Annual Report of the operations of Lloyd's Register for the year 1908-1909 states that at June 30, 1909, 10,424 merchant vessels, registering over $20\frac{1}{4}$ million tons gross, held classes assigned by the society. Of these 8,994 vessels, amounting to 18,670,859 tons, were iron and steel steamers; 1,221, amounting to 1,867,725 tons, were sailing ships; and 209, amounting to 30,992 tons, were wood and composite steam and sail. Of the total 6,803 vessels, of 13,143,632 tons, were British, and 3,621, of 7,425,944 tons, were foreign. Classes were assigned to 550 new vessels of 854,984 tons. Of these 481, of 845,719 tons, were steamers, and 69, of 9,265 tons, were sailing ships. Of the total 470,137 tons, or 55 per cent., were built for the United Kingdom, and 384,847 tons, or 45 per cent., for British Colonies and foreign countries. The serious depression which had existed for so long a time in the shipbuilding industry was, the report continues, again reflected in the amount of tonnage classed by the Society during the year, which was considerably below the very high average attained in recent years. The decrease is not a matter for surprise in view of the fact that the total tonnage under construction in the United Kingdom at the end of June was less than 53 per cent. of the amount building three years before. Since June, 1908, forty-four steamers of 5,000 tons or upwards had received the 100 A1 class and eight vessels between 10,000 and 14,000 tons. Seven steamers, each over 8,000 tons gross, of which the turbine steamer *Chiyo Maru* was the largest, had been built for Japan to class 100 A1, and in each case, except in that of the *Chiyo Maru*, the machinery also was made in that country. Thirty vessels designed for the carriage of oil in bulk were classed. They had a total tonnage of 121,478 tons. The surveying staff at the present time consists of 308 officers. The eight scholarships granted by the society have all been taken up. There were in the Register Book 404 vessels fitted with wireless telegraphy, and 362 vessels fitted with submarine signalling apparatus.

A NEW DESIGN OF BOILER.

"TO making of books there is no end" is a proverb which might fittingly be altered to apply to many appliances in connection with engineering. We have before us the drawing of a new style of boiler which we are pleased to call attention to. It is claimed by the designers to embrace the good points of the ordinary multi-tubular and the water-tube boilers, and to be more efficient and more economical than either. The hot gases after being generated in the furnace pass into a fire box in which are vertical tubes, expanded into a drum at the lower end, and into another at the upper end. The lower drum is connected by a pipe to the lower or dead water space in the main body of the boiler, the connecting pipe, being prolonged well into the water, is perforated, and this connection acts as a circulator, automatically put into action from the time fires are lighted. In this respect it acts in a similar manner to an apparatus which was fitted in one or two steamers some twenty years ago, but without the objectionable features which we then indicated as militating against its adoption. The quantity of water is rather less than in the ordinary type of boiler, an advantage which is further enhanced by the more efficient heating surface due to the tubes in place of the flat heating surface of the usual type of combustion chamber; the total heating surface is also greater on the whole. Engineers deplore the fact that the waste at the boiler end is so great that the total heat units in the fuel form into a greater percentage of loss than of gain, hence any move in the direction of a boiler designed to utilise the heat more effectively and to increase the efficiency with more economical results, should be hailed with satisfaction, and the design before us appears to justify a trial to test its merits.

The figures given for comparison of the new design with the ordinary cylindrical boiler, 11 feet long, under natural draught conditions, are as follows:—

	Ordinary Boiler		New Design of Boiler
Fire-bar length	6′ 0″	....	6′ 0″
Grate area	46 sq. ft.	....	46 sq. ft.
O diam. of tubes	3¼″	....	3¼″
Length of „	7′ 7″	....	7′ 7″
Number of „	182	....	182
Area through tubes	10·95 sq. ft.	....	10·95 sq. ft.
Surface of tubes........	1330 sq. ft.	....	1330 sq. ft.
Other heating surface ..	306 sq. ft.	....	1482 sq. ft.
TOTAL H.S............	1636 sq. ft.	....	2812 sq. ft.
Weight of water	18·6 tons	....	16·34 tons
Weight of boiler	32½ tons	....	31 tons
W. pressure	180 lbs.	....	180 lbs.
RATIO H.S. TO G.S.....	35·5 to 1	....	61 to 1



The McLaren-Weir Marine Boiler.

It will thus be seen that the heating surface is about 75 *per cent.* greater in the new design, while the weight of boiler and water is much less. It is evident that the heating surface in the back end tubes is more effective, due to the hot gases enveloping them, and the body of water in contact with the heat-giving surface being relatively smaller than in the boiler with the flat-back combustion chamber having a water space of seven to eight inches, against which the flame glances on its passage through the tubes to the smoke-box and funnel. The plate fitted at the back end for deflecting the flame on the line of the furnace crown may be considered as liable to burn and buckle, but no doubt there are materials which can be adapted to suit the requirements of the case. The design of the boiler is by Messrs. McLaren & Weir, and Messrs. McLaren & Co., of 62, Leadenhall Street, London, hold the patent rights.

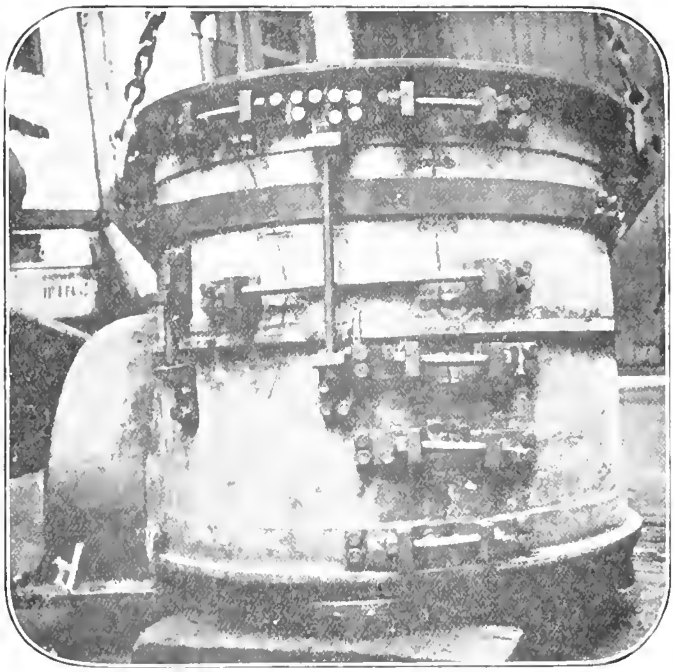
A CURIOUS CASE OF A FRACTURED CYLINDER.

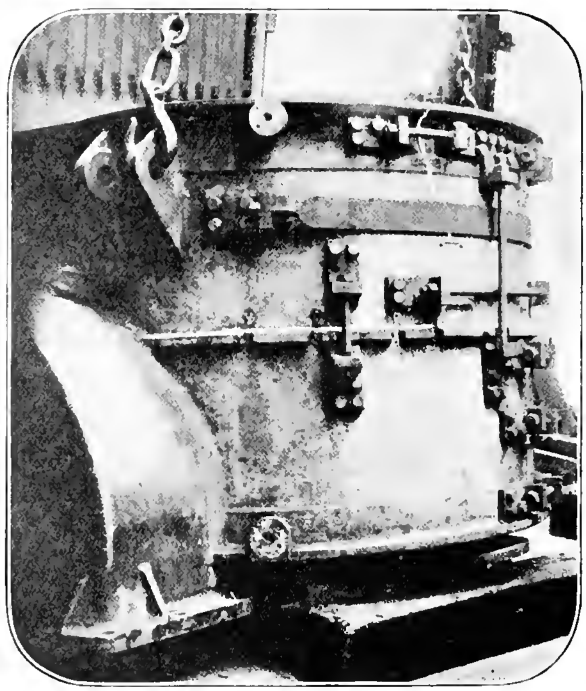
AN unusual accident to a steamer's engines happened recently to a vessel trading on the American coast, when bound from Colon to New York.

According to the chief engineer, all had gone well until about twelve hours out from Colon, when without any warning a sudden shock was felt in the engine-room, followed immediately afterwards by the engines bringing up suddenly. Clouds of steam issuing from the low-pressure cylinder indicated where to look for the trouble. The turning gear was put in, but failed to move the engine, and on the low-pressure cylinder cover being lifted the piston was found to be forced up on the cone and canted in the cylinder. Further examination revealed the fact that the cylinder was cracked in several places, the piston rod was bent, and the stuffing box and gland cracked, the whole of the damage being confined to the low-pressure engine. Although careful search was made nothing could be found to account for the accident, all the junk ring bolts being in place, and the bolts securing the cross-head and crank-pin brasses were found to be intact.

After a considerable amount of trouble the piston was freed and the engine compounded, the vessel then steaming back to Colon, a distance of about ninety miles. There temporary repairs were effected by the Panama Railway Company, which enabled the vessel to steam some two thousand miles to a port where she could get a new cylinder fitted.

The adjoining photographs of the damaged cylinder, after it had been removed to make room for the new one, are of considerable interest as illustrating the very thorough nature of the repair. It will be seen that, in addition to two vertical cracks, one of which extends from top to bottom of the cylinder, there is a large circumferential crack running into one of the vertical ones, so that the cylinder had literally to be tied together before the engine could again be used as a triple. In repairing the cylinder straps were used where necessary, and in addition to the heavy bolted lugs serving to connect the pieces together the cracks were "sewn" by letting in wrought-iron cod pieces at regular intervals flush with the surface of the cylinder. These were fitted so that they could just be hammered in when red-hot, their subsequent contraction on cooling bringing the fractured surfaces much closer together than any amount of screwing up on the bolts connecting the lugs could have done.





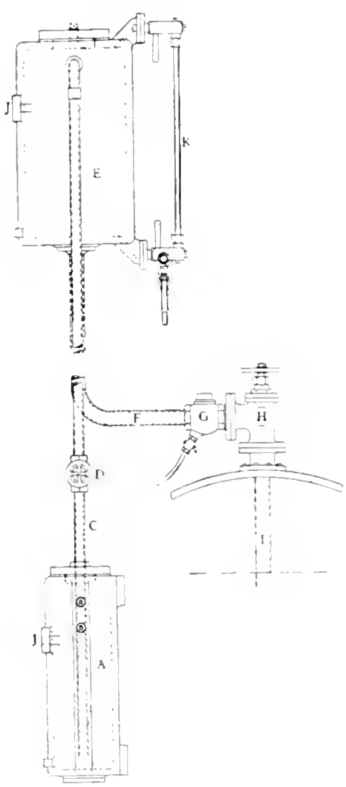
As it was feared that the steamer might have sustained some serious damage to the hull, and in order to examine the propeller, the vessel was docked on her arrival at New York previous to the new cylinder being fitted. The propeller was found to be unbroken and the hull free from any sign of injury. When it is added that the whole of the shafting was also found to be intact, the suggested cause of the disaster that the propeller struck some floating wreckage seems absurd on the face of it.

An experienced engineer will immediately say, "Water in the cylinder! But how? Were the engines not warmed up properly at starting, so that the low-pressure cylinder was coming down at each stroke on a solid body of water, starting the cracks which developed later? or was the water-level in one of the boilers allowed to get too high, causing the boiler to prime badly?"

Former accidents of this kind have usually been accompanied by the wrecking of the whole engine, leaving no trace of the cause; but in this case, where the whole of the engines were afterwards subjected to a most careful inspection without finding anything out of place, it should be possible to arrive at a solution of the problem.

THE WILKINSON THERMAL COLUMN.

It is well known that there is a loss of power by the condensation of steam in supply pipes, but it is doubtful whether the total loss in money value is as fully recognised as it ought to be. The ordinary method of clearing pipes of water is by means of steam traps, but in many instances for various reasons these devices are found to be the most wasteful devices in use in a steam plant. This will be recognised when one remembers that the highest temperature of water at atmospheric pressure is 212° Fahr., while at 180 lbs. pressure it is about 370° Fahr. As the traps usually drain into the hot well, heat is lost during its passage from the trap thereto. We have



pleasure in describing and illustrating an apparatus which has been designed to effectively or economically deal with condensed water, and which is being put on the market under the above title.

As seen from the adjoining diagram the Wilkinson Thermal Column consists of two chambers: (1) the lower, or "sump," and (2) the upper chamber or "receiver." The former is fixed in such a position that the water of condensation draining from the steam range, separators, steam jackets, radiators, etc., can freely flow thereto by gravity. The sump is connected by a rising pipe to the "receiver," which is fixed say 6 or 8 feet above the tops of the boilers, so that the condensed steam (*i.e.*, water), can quickly gravitate therefrom through a suitable connecting pipe, and non-return valve, back to the boilers.

The apparatus is so sensitive that the heat radiation through good "non-conducting" covering material is sufficient to ensure its effective working and the automatic return of the condensed steam direct to the boiler.

It is claimed that the efficiency is so high that the condensed steam can be lifted from the sump and returned to the boilers with a maximum drop in temperature of less than 1° Fahr. per foot of lift, a result that is probably unapproached by any other apparatus on the market. There is no outlet whatever to atmosphere, and the whole of the water, at a temperature close to that of the steam, is within a very short time of its actual condensation in the steam range silently carried back direct to the boiler.

Another important and unique feature of the Thermal Column is that it works by difference in temperature and not by volume, so that its efficiency is independent of the amount of condensation which may be taking place in the steam pipes, cylinder jackets, etc.

It is well known that the amount of condensation varies greatly, being heaviest during the hours when the steam plant is lightly loaded, and, therefore, any automatic system designed to work by volume would have a low efficiency at all times, especially when heavy loads were being carried by the boilers, whereas the Thermal Column has a uniformly high efficiency under all circumstances.

The principle on which this device works may not be quite clear at first sight, but it will be readily understood after perusal of the following:—

The apparatus works due to the fact that directly a body of steam is cut off from the source of supply it cools rapidly and the pressure drops. For instance, steam at 150 lbs. pressure has a sensible temperature of 366° Fahr.; at 361° Fahr. temperature the pressure is 10 lbs. less, which is sufficient to lift a column of water (in round figures), 20 ft.

Bearing these facts in mind it will be noted on reference to the diagram that when there is no water of condensation in the sump *A*, the steam has free access up the rising pipe *C* into the top receiver *E*. Directly sufficient water of condensation drains into the sump from the steam range through the inlets *B*, and the bottom of the rising pipe *C* is immersed in water, then the rising pipe *C* and the receiver *E* are cut off from the source of steam supply. The steam already impounded quickly drops in pressure and therefore the water rises up the pipe *C* into the receiver *E*. Directly the water in the sump *A* has been lifted into *E*, steam follows up the rising pipe *C*, establishing equilibrium of pressure on the top of the water in *E*, when the said water is free to gravitate through the pipe *F* and the check valve *G* into the boiler or boilers to which it may be connected.

The receiver *E* is of such capacity that, notwithstanding the periods during which it is discharging its contents to the boiler, the maximum amount of condensation water formed in the steam range during each cycle is incapable of filling the said receiver *E*, that is, the amount of water collected in the sump and entraining pipes during the period of time when the receiver is discharging to the boiler and being refilled is less than the receiving chamber will hold.

Should at any time the top receiver and the rising pipe become full of water, due say to the priming of a boiler, opening out of a length of cold steam pipe,

or any other abnormal cause, an automatic relief valve is provided on the receiver, which allows such excess of water to escape, until the rising pipe again becomes charged with steam, when the apparatus resumes its normal work. Such flooding will not occur under ordinary working conditions.

The Thermal Column is being adapted for use on board ship, for the dual purpose of draining the main steam pipe, and also for passing the drain water from the cylinders, after elimination of the oil, back direct to the boilers in its hot state immediately after it has issued from the cylinder drains, thus doing away with steam traps entirely, and securing the maximum efficiency and economy both of coal and water.

This device is the invention of Mr. George Wilkinson, M.I.Mech.E., M.I.E.E., of Beech Mount, Harrogate.

LLOYD'S REGISTER OF BRITISH AND FOREIGN SHIPPING.

Election of Chairman.

The General Committee of Lloyd's Register held a special meeting on October 28th for the election of a chairman of the society in succession to the late Mr. James Dixon.

Mr. Thomas L. Devitt and Mr. William Lund had been nominated, but the latter having withdrawn, Mr. Devitt was unanimously appointed to fill the office in question.

Mr. Devitt has been a member of the committee since 1893, and has already held for two years, in conjunction with Mr. William Lund, the office of chairman of the Sub-Committees of Classification of the Society.

Mr. Devitt is one of the best-known men in the shipping community. He is the senior partner in the firm of Messrs. Devitt & Moore, and also a partner in the firm of Messrs. F. Green & Co., who, with Messrs. Anderson, Anderson and Co., are the managers of the Orient Steam Navigation Co., Ltd. As indicating his reputation and standing among shipowners, it may be mentioned that he has filled the offices of president of the Chamber of Shipping of the United Kingdom, and chairman of the General Shipowners' Society, and was a member of the Advisory Committee of the Board of Trade in connection with merchant shipping. He has also been president of the Shipping Federation since the inauguration of that body, and has recently been elected president of the International Shipping Federation.

As is well known, the Society of Lloyd's Register by its constitution unites both the shipowning and underwriting interests, and in this connection it is not out of place to mention that Mr. Devitt has for many years been an underwriting member of Lloyd's.

The charities connected with the mercantile marine have always had an ardent supporter in Mr. Devitt. He is the chairman of the Royal Merchant Seamen's Orphanage, Snaresbrook, and a trustee of the Royal Alfred Aged Merchant Seamen's Institution, Belvedere, Kent. In association with Lord Brassey, Messrs. Devitt & Moore started the well-known "Brassey" scheme for the training of officers for the merchant service and for the Indian marine, which has achieved great success. The firm's four-masted barque *Port Jackson* is still employed in carrying out this scheme.

It may be added that Mr. Devitt has twice been Master of the Skinners' Company, and is a vice-president of the Equitable Assurance Company.

Messrs. J. Dampney & Co., Ltd.—We are informed that Messrs. J. Dampney & Co., Ltd., of Post Office Chambers, Cardiff, manufacturers of the well-known Anti-fouling Compositions for Ships' Bottoms, also "ApeXior" Compound for preventing Incrustation and Corrosion in Steam Boilers are this week removing to the Merchants' Exchange, where they have secured much more extensive and commodious offices.

INSTITUTE OF MARINE ENGINEERS.

19th Annual Dinner.

Presentation to Mr. James Adamson.

The nineteenth Annual Dinner of the Institute took place at the King's Hall, Holborn Restaurant, on Wednesday, November 3rd, 1909. Mr. James Denny occupied the Chair, and the following gentlemen presided at the tables: Messrs. Geo. Adams (Member of Council), P. T. Campbell (Member of Council), Professor A. C. Elliott, D.Sc. (Vice-President), J. G. Hawthorn (Hon. Minute Secretary), J. Lang, R.N.R. (Member of Council), Wm. Lawrie (Vice-President), Robert Leslie, R.N.R. (Vice-President), J. T. Milton (Chairman of Council), and W. I. Taylor (Member of Council). The guests at the Chairman's table were Admiral Sir Archibald L. Douglas, G.C.V.O., K.C.B., Sir Walter J. Howell, K.C.B., T. J. Macnamara, Esq., LL.D., M.P. (Parliamentary Secretary to the Admiralty), Alfred A. Booth, Esq. (Chairman, Cunard Steamship Company), Engineer Vice-Admiral H. J. Oram, C.B., Dr. John Inglis, Pointhouse; Colonel John M. Denny, Dumbarton; D. J. Dunlop, Esq., Port Glasgow; Senor Don S. G. de los Rios; Dr. Robert Caird, Greenock; Jas. Adamson, Esq., Hon. Secretary; Thomas Bell, Esq., Clydebank; W. M. Mordey, Esq., President Institution of Electrical Engineers; Summers Hunter, Esq., President N.E. Coast Inst. of Engineers and Shipbuilders; Henry Adams, Esq., President Assoc. of Engineers-in-Charge; W. McLeod McMillan, Esq., Dumbarton; Alexander Boyle, Esq., Chief Engineer Surveyor, Board of Trade; S. J. P. Thearle, Esq., Chief Ship Surveyor, Lloyd's Register; John Gravell, Esq., Bureau Veritas Register of Shipping; Andrew Scott, Esq., Secretary, Lloyd's Register of Shipping; Engineer Commander W. McK. Wisnom, R.N.; Captain G. F. Dixon; Robt. Clark, Esq.; Professor J. H. Biles, LL.D.; H. J. Cornish, Esq.

After the loyal toasts had been pledged Sir Walter J. Howell proposed the toast of "The Sea and Land Forces." Admiral Sir Archibald L. Douglas, replying on behalf of the Navy, stated that when he joined the Navy fifty-two years ago the only machinery on board a ship was the chain pump. Now vessels were full of machinery, and no officer was fitted for duty unless he had some knowledge of engineering.

Colonel John M. Denny responded on behalf of the Land Forces of the Empire and paid a tribute to the scheme of Mr. Haldane, for the organization of the Territorial Forces. He urged every man to take upon himself the spirit of enthusiasm and join that force and be ready to take part in the defence of his country.

The Chairman at this stage of the proceedings explained why he happened to be in the Chair. When Mr. Dixon, who had been selected as President, had died quite unexpectedly, to the great loss of that Society with which he was associated, his family, his friends and the Institute, the Council were placed in a dilemma. The only course for them to follow was to select one of the Past Presidents temporarily to fill the position. As there were so many distinguished Past Presidents, any choice that they made must have seemed somewhat invidious. They followed what was perhaps the most natural course, which was to ask the President whose term of office had just expired to act for another year. That explained his presence in the Chair as President for a second year in succession. He continued, that the Institute had now attained its majority and the event was to be marked by a very well-earned recognition of the services of that gentleman who, more than any other, had contributed to the success that had followed the Institute. He need not say that he referred to Mr. James Adamson. For twenty-one years Mr. Adamson had been Honorary Secretary, to the great benefit of the Institute. Mr. Adamson's forefathers hailed from Aberdeen, which accounted for many of the sterling qualities which they had found in him, but which, on the other hand, did not account for the absence of some of those less pleasing characteristics which were supposed to mark out the inhabitants of that ancient and interesting city. Mr. Adamson was educated at Dollar Academy and Glasgow University, while he had also passed through the stages of apprentice engineer, journeyman and sea-going engineer, and so well did he acquit himself in the service of the British India Company that he became the dock superintendent engineer

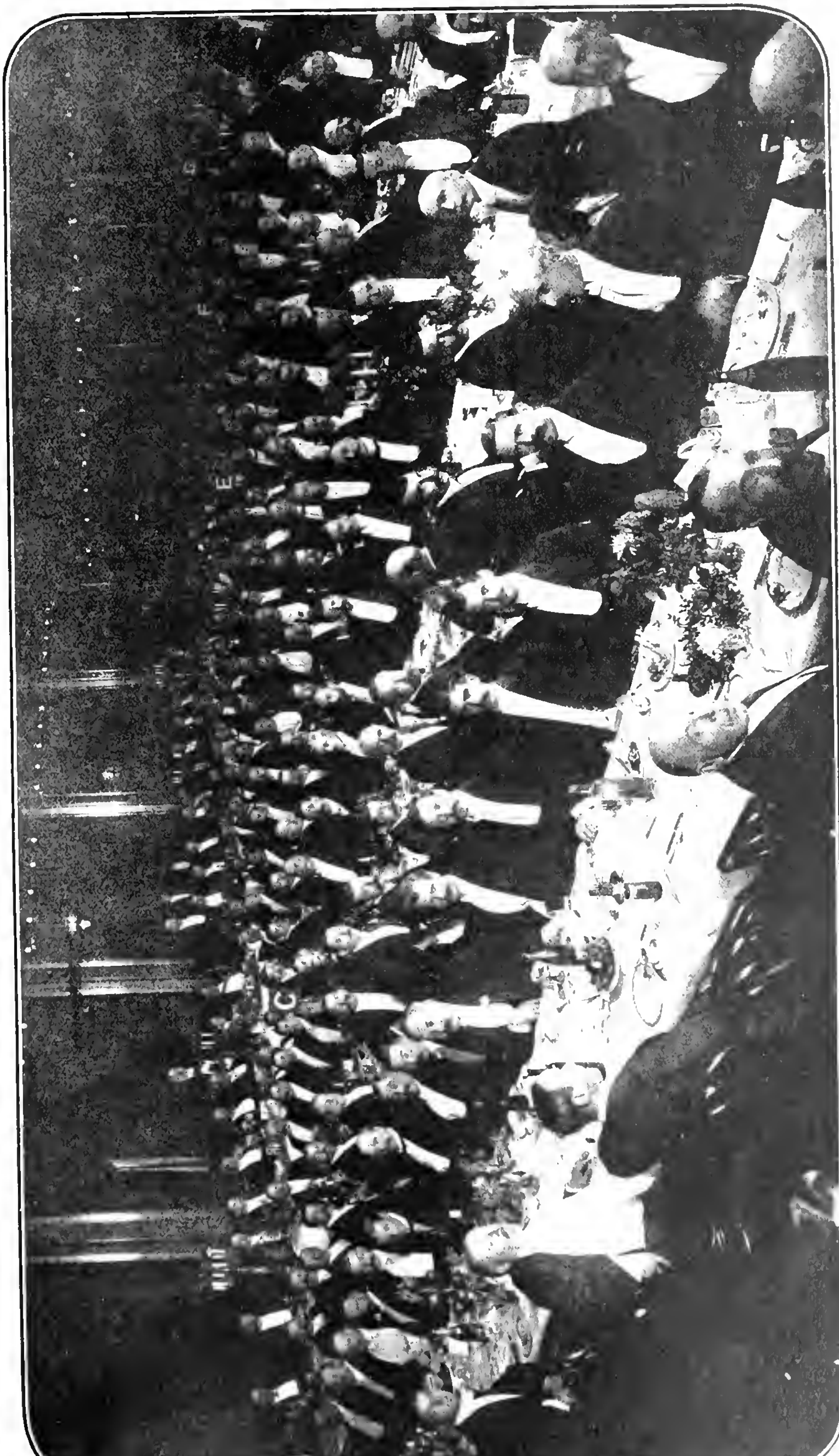


Photo by Fradelle & Young, London

The Institute of Marine Engineers,
19th Annual Dinner, November 3rd, 1909,
at
King's Hall, Holborn, London.

for all their vessels sailing in and out of London. That was a fortunate circumstance, because owing to his settlement in London, he had been able to put into practice an idea which was now the Institute of Marine Engineers. Acting along with a very small number of other gentlemen, Mr. Adamson started the Institute, and became its Honorary Secretary. He had become one of the best-known personalities, and most popular in marine engineering circles all over the world. It was a wonder to those who knew him how he got through the work that had thus fallen upon him. Apart from the work done for the Institute he was engaged in many works of philanthropy and had also, each day of his life, to put through a hard day's work in the interests of his employers. It appeared as if Mr. Adamson's case must be another of those which most of them had learnt by experience, that the more a man had to do—that is, the proper kind of man—the more time he found to do it in. The work he had done for the Institute had been a labour of love in the same way as the work he had done for his employers had been his life's duty, and how much he had done and how much it was appreciated by his employers many of them could personally testify. Mr. Adamson had done the work well, and it was true to say that he had made the Institute what it was to-day. The number of men who had assembled to initiate the Institute was thirteen. It did not sound a very lucky number, but lucky or unlucky they had gone on, and the number at present on the roll, after a rigorous purging, was 1161. Its membership never was greater, its finances more flourishing, its recognition by outside bodies more general, or its practical work more active and valuable than in this year of its majority, due in a great measure to the exertions of Mr. Adamson. Mr. Adamson having been the main active driving force in the rise and progress of the Institute, it is no cause for wonder that it had been determined to recognise his services. The scheme had been well received and a sum of £530, in amounts varying from £25 to 2/-, had been subscribed. The Committee had decided to present Mr. Adamson with a cheque for part of that sum, also presenting to Mrs. Adamson a writing bureau; the remainder was to be expended on a portrait of Mr. Adamson, which would be hung in the Institute at Stratford. This would be peculiarly fitting, as the life work of Mr. Adamson had been carried on in those rooms.

The presentation was then made to Mr. Adamson.

Mr. Adamson, in returning thanks, said he was deeply sensible of the kindly thoughts which had animated them in presenting him with so munificent a gift. He accepted it with a heart full of thankfulness, deeply conscious of the great honour they had conferred upon him by placing him in the unique position he now occupied as the recipient of a spontaneous gift. His work for the Institute had been to him a recreation, a labour of love in which he had had great pleasure without thought of reward save that arising from the consciousness that it was a good patriotic work worth doing and also worth devoting time, labour and money on in the hope that the marine engineer and his duties would be magnified both in his own eye and in that of the public, and with a view to kindling a higher appreciation of his value to the State, of which he was a valuable national asset, and to extend the knowledge and experience of engineers in the details of the extensions in marine engineering practice. Another aspect of marine life which the Institute had tended to improve was the relationship between the deck and the engine room, by inculcating the principle of mutual respect. Continuing, Mr. Adamson said that the subjects of the papers read before the Institute were of a varied nature and afforded scope in their discussion for everyone to take part in one way or another by written or verbal communication. He agreed with the utterance recently given by the Principal of the West of Scotland Technical College to the effect that every engineer should associate himself with at least one technical society. The advantages to be derived from such association were too obvious to need dwelling upon. In looking back through the records of the Institute, it was found that they had not met with any great vicissitudes, nor could it be said that they had pursued the even tenour of their way without critical experiences, involving a considerable shaking up of brain and muscle. These were the natural outcome of the struggle for existence on the higher planes of life as on those of the lower such tended to give grit and stamina, so the Institute withal had prospered and moved ahead. The roll of Past Presidents contained the names of men distinguished in, and representative of, different lines of life, indicating that not only had the Institute commended itself to the engineering world, but to those of science, shipping and commerce. In respect to the persons of the Presidents who had honoured them by their acceptance of the office, it was most difficult to speak of one alone in a special sense. He was assured, however, that he would not be misunderstood, but be acquitted of making unduly invidious distinctions, when he named the late Dr. Peter Denny, to whose liberality they were indebted for the foundation of the Gold Medal and the financial assistance arising therefrom, which had formed a good step towards obtaining the freehold premises at Stratford. His own recollections of Dr. Denny dated back many years, and to him he owed many pleasant associations which had been passed on and maintained by others of his name and lineage who were now present, and not the least pleasant of these associations was that of the present occasion. He was proud to know that the result declared that evening had been reached by so wide-spread a response, embracing all grades of membership—a fact which enhanced the gift immensely. It added to the treasure house of his memory and to the place the event occupied in his heart. He was proud of the Institute and of his association with it. He owed very hearty thanks to the Committee for the self-denying labour in connection with the work of putting the machinery in motion and keeping it going to bring about what was to him a gratifying surprise. The presence of Mr. P. T. Campbell, the Convener of the Committee, that evening was a delight and a cause for thankfulness to all who had been associated with him, and they rejoiced to welcome him back to duty after his severe illness.

Mr. Summers Hunter proposed the toast of "The Institute of Marine Engineers." He said that the North-East Coast Institution of Engineers and Shipbuilders were proud to recognise the Institute of Marine Engineers as fellow-workers in the interest of their national industry. They had a record to be proud of from an educational point of view, and the papers read before the Institution were of a very high class. They could not but be interesting to those who had the privilege and opportunity of listening to them. Members of the Institute were to be found all over the world, which fact, he thought, spoke volumes for the usefulness and importance of the Institute. He considered that marine engineering was a life work for any man, and that knowledge of its advances was propagated through the medium of the papers read before the Institute. He was glad to see that they had amongst their members engineers in the mercantile marine, as well as Naval engineers. The old mercantile marine engineer used to be known as the "man with the spanner," the Naval engineer as the "man with the sword." These two types were gradually coming nearer, and the more closely they were allied so much the better for the welfare, not only of the ship, but of the whole country. The training of engineers to-day is a very different thing from what it was ten years ago. As in the Navy they have what is known as the "new entry" of engineers, so in the mercantile marine, and it is gratifying to know that this class of engineers had been received with great warmth. He commences studying at an early age, fifteen or sixteen years, and in many of the public schools this branch of education is taken and is found to be very satisfactory and to give a very good foundation for an engineering career. These young engineers, after leaving school and starting in the works, are given facilities for attending technical colleges, engineering colleges and universities, with the result that at the age of twenty is evolved a highly-trained engineer who had combined with theoretical knowledge practical experience. Men of this kind will not be known as the "spanner" engineers, but something more akin to the "sword" engineers, and the time may come when they will take their part in the defence of the empire.

Mr. J. T. Milton replied. He said that the Institute was one of the assets of the country, because it had for its object the training of men on whom the welfare of other professions largely depend. Marine engineering was so important that the very food of the people of the country depended on the marine engineer bringing home a plentiful supply. The Institute was prospering greatly. It had added to its members, yet they were far from satisfied with the progress. They should have considerably more members than they had. It was in the interests of all engineers to

join, which he hoped they would do. There were some who thought that they were not growing as they ought to do. His advice was to "Work—Work," bring in more members and so enable the Council to carry out improvements they so much desired.

Dr. T. J. Macnamara proposed the toast of "The Shipping and Commerce of the Empire." To submit the toast was, he said to weave a romance of enterprise and courage, of foresight and splendid industry, each deeply established in unwavering faith. The application of steam to sea transport was one of the landmarks of the nineteenth century. It had brought the uttermost ends of the earth within easy touch one of the other; it had put the members of our far-flung empire each on the others' visiting list; it had brought the fruits of the earth, each in its due season, to the tables of the poorest in the land; it had brought the bales of merchandise to our wharves to find work for the busy hands in the mills, factories and workshops. Dr. Macnamara traced the development of Atlantic steam shipping from the *Savannah* down to the *Mauretania*, and, indicating the growth of our merchant shipping, he dealt with the expansion of our foreign and colonial trade. The situation to-day was that 44,000,000 of people at home depended for their daily food and daily occupation, to an extent that many did not realize, upon seaborne cargo. Last year 29,000,000 cwts. of wheat was grown in the United Kingdom; 104,000,000 cwts. were imported, which means that four out of every five loaves of bread eaten at home has been made from wheat grown abroad. Of the £593,000,000 worth of imports last year, £240,000 000 worth was on account of imported food, and £203,000,000 worth was raw or partially raw material. If that steady homeward procession were to be dislocated, want and destitution would cast their shadow over the land. Not only that, but £459,000,000 worth found its way outward. He wondered if the mill hands, factory hands, mechanics, clerks, bakers and all the millions of workers who pursue their work day after day quite realized what they owed to British merchant shipping. He referred to one branch of work at the Admiralty which had a direct bearing upon the safe coming and going of merchant shipping, *viz.*, the work carried on by the hydrographer and his staff, who collects information from our own special vessels and other sources, and which information enables him to compile new, and to correct old ones, in such a way as to make the charts of the British Admiralty the standard guide books for the mariners of the world.

Mr. Alfred A. Booth replied. He said the Institute of Marine Engineers, in the mind of every man interested in the sea, stands for the most important branch of one of the greatest professions in the world. They all recognised nowadays the necessity of placing the best theoretical training within the reach of every man. A School of Engineering or Mechanical Science was now an essential component of every properly equipped university. That general recognition was not, however, of very long standing. The honours School of Mechanical Science at Cambridge, for instance, was only established when he was an undergraduate and he was always glad to remember that he gave the new movement the most practical help he could at the time by submitting himself as a candidate for the Mechanical Science tripos. But even now they did not sufficiently recognise the value of mechanical science as an educational instrument for any boy of scientific rather than literary tastes. It appeared to him that the elements of astronomy and engineering ought to follow as naturally and inevitably in the wake of mathematics as Ovid and Cæsar follow the teaching of Latin grammar. Dealing with shipping affairs Mr. Booth said he had never met a shipowner who was ready to admit that his steamers were making money. If his balance sheet told a more flattering tale it was said to be due to reserves wisely set aside in by-gone years when the world was a brighter and better place for shipowners. It could not at any rate be denied that there was more tonnage in existence to-day than could be absorbed by any conceivable development of the world's trade in the immediate future. Yet they found that shipowners were beginning to build new ships again as merrily as ever. What was the explanation of this strange state of affairs? There might be a great many contributing causes, but he would confine himself to two—one economic and the other sentimental. The effective life of a steel steamer may be variously estimated from ten years—if you were dealing with an income-tax assessor—to twenty—if you were issuing a prospectus—even to infinity if you were trying to cover up a bad balance sheet. But in any case the fact remained that the shipowner had to provide for depreciation on his entire plant at the same high rate that a manufacturer need apply only to his machinery. When bad times came, the shipowner shut his eyes to this heavy indirect charge, and is well content if he can make both ends meet on voyage account. He might even go on running his steamers long after a considerable separation had taken place between the two ends, either to maintain a trade, or to earn a manager's commission. If one particular ship showed worse results than the rest, he would build a new one in her place to run at a little less loss, and then, finding that he could not sell the old ship at anything like her book value, like a true sportsman he would run them both. The result of all this is that in bad times the ship was not laid up till long after the mill was shut down, and it takes a long while to get out of the rut of bad trade and low freights. The second explanation is simply that shipowning is the finest game in the world—not excepting politics—and no shipowner wants to be anything else, except, possibly, a marine engineer. It follows that there must always be a superfluity of shipowners and therefore a superfluity of ships.

Mr. W. Lawrie gave the toast of "The Guests and Kindred Associations," and thought that the consistent support of the shipowners was a matter that they might congratulate themselves upon.

Dr. Robert Caird, in a happy speech, and Mr. W. M. Mordey replied.

Mr. W. M. Mordey said that he thanked them on behalf of 6,200 members of the Institution of Electrical Engineers. He sincerely hoped that in the future electrical engineers might be of greater service to marine engineers than they had been in the past. In 1882 he helped to put into the old *Sirius* the installation of arc lighting, which was the first example of electric lighting of a warship in the world, and since then he had seen the application of electricity gradually growing until the mere lighting of the ship was a matter of comparatively little importance; he had seen it gradually taking to itself a great deal of the auxiliary work on ships, particularly ships of war, and he noted that there was even a movement in favour of giving electrical engineers something more honourable. One of the Institute's papers, a very able one, by Mr. Durtnall, presented the case for the electrical propulsion of ships by interposing electrical machinery between the prime mover, whatever it may be, and the propeller. He believed that the question of such applications had gradually forced its way by reason of the advantages which would be gained by their adoption. It would be found that in many cases great advantages would accrue from using electrical methods as a gear for engines running at a high speed while the screw was at a low speed, and the advantages of such a combination, particularly with ships running at very varying speeds, would be found sufficient to justify the expense necessary; in fact it is claimed that the economies would be so great that the result will lessen the cost for the whole ship. Proceeding, Mr. Mordey said we had heard of the centenary celebrations of the first steamboat traffic on the Hudson, and the celebration of the ter-centenary of the discovery of that river and bay by Hudson. It had not been so often pointed out in these celebrations, however, how much of the success of that first steamboat on the Hudson was due to this country. It was a Watt engine, built at Soho, near Birmingham taken over by Fulton and put in that boat. It was a British engineer that made that experiment of Fulton's possible, and it was the lesson that Symington taught Fulton when Fulton visited him in Scotland and saw the still earlier steamer running there, that led Fulton to get Watt to make his engine for the vessel on the Hudson. What had been the most profound change in marine engineering of later years? It was the result of the practice and work of Parsons, work that enables another Briton to stand beside the great ones of the past, Watt and Faraday, who were the founders of our steam engineering and electrical engineering. It was interesting to recall the fact that the first steamer that plied on the Thames was the little boat built by William Denny, and which ran in 1814. It was very wonderful when one looks up the record of these things to find how much Scotland

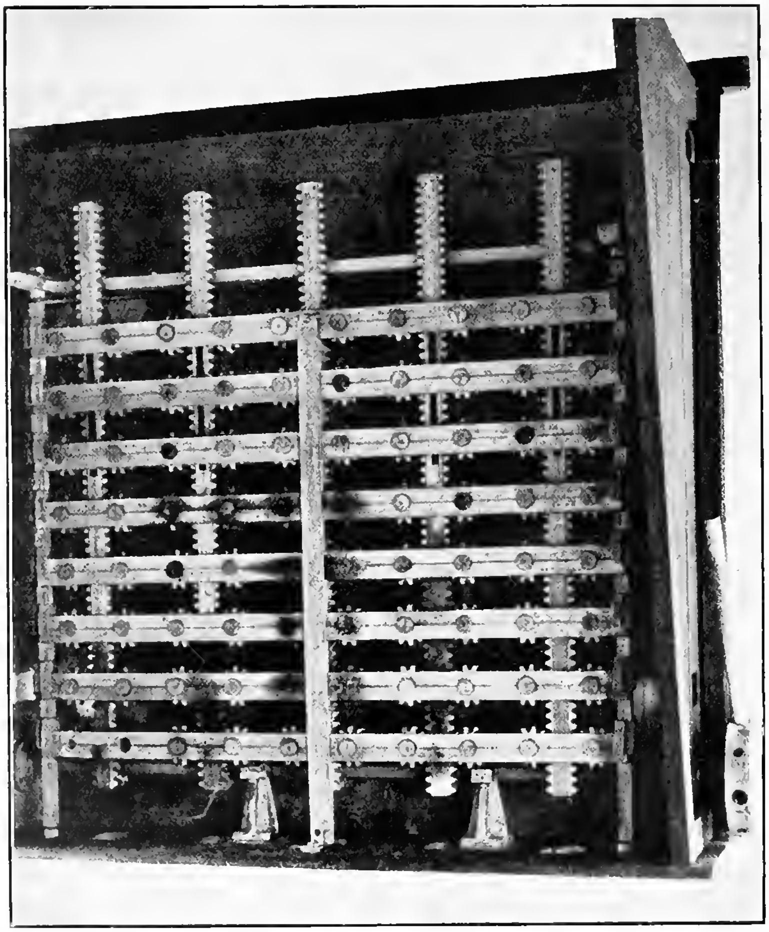
had done for marine engineering and engineering of all kinds. As an electrical engineer he had the great privilege of calling attention at Glasgow a short while ago to the fact that it was in Scotland that the first electrical traction work was done, work that was done and forgotten entirely as far back as 1842. An Aberdeen man, called Robert Davison, ran an electrical carriage on the Edinburgh and Glasgow Railway, and ran it at a speed of ten miles an hour. Before any steam locomotive ran on that line an experimental carriage was run by the Aberdeen man, and he was glad, as an electrical engineer, to acknowledge how much is due to Scotland, not only in electrical engineering but also in every branch of engineering.

Professor A. C. Elliott proposed the health of "The Chairman." He pointed out that the firm goes back, so far as the marine engine is concerned, nearly 100 years, only a brief year behind the work of Henry Bell, who built the "Comet" between the years 1811 and 1812. Dr. Peter Denny, who had been referred to by Mr. Adamson, was a friend to whom the Institute would always owe a debt of gratitude. The Dennys had always been to the fore. They were the first to introduce the screw propeller, the cellular double bottom and the quadruple engine. They had made notable contributions to the scientific side of naval architecture, and their works were matched by those of no other town in the world; their method of dealing with their apprentices and workpeople was a model to the world. The greatest development of recent years in marine engineering had been that of the turbine, which now dates back to eight or nine years ago, and there again the Dennys were the first, with the "King Edward" and the "Queen Alexandra," the experimental ships

Mr. Denny suitably responded.

APPARATUS FOR CLEARING BOILER TUBES.

Descriptive references have been made in some of our former issues to appliances for clearing and keeping free from soot and light ashes the tubes of a boiler while under way, and our attention has been called to another appliance sufficiently differing from the others to justify an illustration of it being reproduced here. Being a new design made in the full knowledge of what has been experienced with others it has the merit arising from the pilotage of a designer who knows the Scylla and Charybdis to avoid. We had recently an opportunity of seeing this appliance fitted in a marine boiler. The special feature of the apparatus is that the frame is built up, and is consequently not affected by the heat in any way to interfere with efficient working. In this latest appliance the framework is securely fixed to the smoke box in front of the tubes. The motion is transmitted to the retarders in the tubes by means of racks and pinions, the whole being actuated by a lever and boss in the wing outside the smoke box. To remove a retarder for the purpose of tube-stopping, the centre vertical bar and the cross bars on the frame are secured by pins to admit of



Apparatus for clearing Boiler Tubes

ready removal and replacement, the bottom bar being in halves lengthway to facilitate speedy disconnecting. Each cross bar is firmly held in position by clips running on the vertical bars at each side. This new appliance has been patented, and is manufactured by the Glasgow Patents Company, to whose works we have previously had occasion to refer, and to whose courtesy we are indebted for the photograph now reproduced.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

Portsmouth Dockyard.

PREPARATIONS for commencing the new battleship, which it has been officially announced is to be named the *Orion*, are well advanced. It is understood that she will be over 22,000 tons displacement and have a speed of 21 knots. It is said that the arrangement of her guns will be quite a new feature, as her ten 12-inch guns are to be on the middle line of the ship. A large quantity of material has arrived and additional derricks have been erected at the slip, as the new vessel is to be 600 feet long and 86 feet wide. With this increase in width comes the question of docking accommodation. The only dock here capable of taking a *Dreadnought* is No. 15, but that is not wide enough for a vessel such as the new one is to be. It is, however, understood that when the new lock has been completed one, if not two, large docks will be constructed, one to open out of No. 4 basin and the other out of No. 5. In the meantime one of the two floating docks now being built to the order of the Admiralty by private contract is to be sent here and placed in a specially prepared berth in Fountain Lake. The floating dock will be 100 feet wide, 650 feet long, and 600 feet long over the blocks, and its lifting capacity will be 35,000 tons. The steam trials of the battleship *St. Vincent* are to take place at the end of November or the beginning of December. The gunnery trials will follow and the ship will then return to be completed for service in the Home Fleet, and she should be commissioned early in the New Year. The battleship *Renown* has been taken into harbour to be prepared for service as a training ship for stokers, in place of the old hulk *Nelson*, which has done duty for many years. The *Renown* was the vessel in which the Prince of Wales went to India. On that occasion all her 6-inch guns and many of her larger fittings were removed and were never replaced, so there is plenty of room on board for the young stokers. The old battleship *Edinburgh* has arrived for gunnery trials with a 13.5-inch gun which has been mounted in the battleship *Revenge*. The trials are secret, and the Admiralty made a special request to the press not to publish anything about the matter. A singular accident happened in the harbour during a dense fog at the beginning of the month. As a torpedo boat was leaving she was carried across the bows of a yacht, whose bowsprit swept the deck of the little craft, clearing away her masts and funnel and doing other damage. Luckily there were no personal injuries. There have been several changes here of late. Engineer-Rear-Admiral Bennett, M.V.O., who had been on the staff of Admiral Sir Arthur Fanshawe, the Commander-in-Chief, for the past fourteen months, has retired after nearly thirty-nine years' service. When engineer-captain of the Royal yacht *Victoria and Albert*, he was made a member of the Royal Victorian Order on the occasion of the King's visit to Malta six years ago. He has been succeeded by Engineer-Rear-Admiral Wishart, from Devonport. Engineer-Commander Whayman, the first assistant to the manager of the Engineering Department, has gone to the Controller's Department at the Admiralty, and he has been succeeded by Engineer-Commander Beckett, from Malta. Rear-Admiral Brock succeeded Rear-Admiral Bush in command of the local division of the Home Fleet, and hoisted his flag for the first time, having only been promoted to flag rank eighteen months ago. Lieutenant Alston, of the King's Harbourmaster's Department, is also retiring, with the permission of the Admiralty, to go to Newcastle-on-Tyne to take up the post of master attendant to the firm of Messrs. Armstrong, Whitworth & Company.

Devonport Dockyard.

The cruiser *Indefatigable* was launched as arranged on October 28th by Lady Loreburn in the presence of a most influential company, including several peers, generals and admirals, in addition to the officers of the Russian squadron, which was on a visit to the port. Lady Loreburn received from the officers of the old cruiser *Indefatigable*, which is in the West Indies, a telegram wishing "Success to our baby sister." The new cruiser to be laid down is to be named the *Lion*. The last vessel of the name was, it is interesting to note, stationed at this port for many years and used as a training ship. The *Lion* is to be the most formidable cruiser in the world. She will be over 26,000 tons and 700 feet long, while her speed is to be 28 knots—three knots faster than any cruiser now afloat. The mounting of the guns of the battleship *Collingwood* is making excellent progress, the work having been greatly expedited by the use of the new 150-ton electrically worked crane. The cruiser *Highflyer* has come in for a refit at a cost of £43,338, of which £24,000 will be for labour. The cruiser *Hogue* has left to join the Home Fleet at the Nore. An explosion of coal gas recently occurred in one of her bunkers, resulting in injury to several stokers, two of whom subsequently died in hospital. None of the dockyard men on board were injured and no damage was done to the ship. It has been decided to fit several torpedo gunboats as mine searchers and for this purpose the *Gossamer* will shortly be taken in hand. A quantity of fittings and stores have been salved from the destroyer *Lee*, which, as stated last month, was wrecked on the west coast of Ireland. During the progress of a torpedo boat attack on the battleship *Hannibal* off Berry Head, Torbay, on the evening of October 29th, torpedo boat No. 105 crashed into the *Hannibal* without, of course, doing any damage to the battleship. She, however, battered in her own bows and is now in dockyard hands. The training establishment for mechanicians, for which purpose the hulk *Indus* is used, will, it is understood, shortly be transferred to Chatham. Engineer-Rear-Admiral Wishart, who has been manager of the Engineering Department since July, 1907, has gone to Portsmouth on the staff of the Commander-in-Chief at that port. It is in a way a promotion, as it carries with it a salary of about £150 beyond the £1000 a year that he received here. Admiral Wishart has been succeeded by Engineer-Commander Anstey, who has been at the Admiralty for the past twelve months. It may seem strange that an Admiral should be succeeded by a Commander, but these appointments are made irrespective of rank.

Sheerness Dockyard.

It is understood that one of the two new floating docks which the Admiralty are having constructed by contract is to be stationed in the Medway. Should this prove to be the case, it will considerably add to the facilities of the port, seeing that the docks are made to hold a battleship of 650 feet in length, 100 feet in width, and 35,000 tons displacement. The ships of the Third Division of the Home Fleet have returned from their firing exercises. The division has just been strengthened by the addition of the cruiser *Hogue* from Devonport. It now consists of three battleships, three armoured cruisers and two protected cruisers. The ships of the First and Second Divisions of the Home Fleet are at Portland, where they are expected to remain during the greater part of the winter. The First Destroyer Flotilla, it was also anticipated, would winter at Portland, but orders have been issued for the vessels to remain at Harwich. The *Crusader* recently joined the flotilla in relief of the *Ettrick*. She is the ninth ocean-going destroyer to join the First Flotilla, and three others are to join—the *Viking*, *Zulu* and *Maori*. The *Saracen* met with a mishap soon after taking up her duties, having come into collision with the steamer *Surf* of London in the North Sea near the Shipwash Light about ten miles from Harwich. The damage to the destroyer's bows extended from the upper deck to the keel and her stem was bent three feet to starboard. The starboard engine was injured when the machinery was suddenly reversed in the endeavour to avoid a collision, and she came in escorted by the destroyer *Locust* with only her port engine working. In consequence of the work on the *Saracen*, the

refit of the destroyer *Swale* has been temporarily deferred and she went back to Harwich to rejoin the flotilla. The *Cherwell* has been taken in hand and the *Ure* has gone into the steam basin, while the *Tartar* has also come in for a refit. The *Cossack* has rejoined the flotilla, after having her armament strengthened by two additional 12-pounder guns and undergoing a thorough refit. The *Nubian*, which also came in for docking, has rejoined the flotilla. The *Crusader*, another new vessel which only recently joined the flotilla, collided with the *Rother* during the night of November 2nd near the Longsand lightship. The stem and plates of the latter vessel were bent, and she was temporarily repaired at Harwich by the parent ship *Blenheim*. The *Erne*, which had been in dockyard hands for the past three months, has gone to Portland to begin duties in the Second Destroyer Flotilla to which she was transferred on being relieved in the First Flotilla by the *Afridi*. Six of the nine submarines of Section III. (Nore) flotilla are at present here, but only *C* 2, *C* 5 and *C* 6 are in dock. *C* 7, *C* 8 and *C* 9 have completed their refits, and when they have had their electric batteries overhauled will proceed to Harwich to resume their duties. At the adjourned inquest on Stoker Kissick, whose body was the only one recovered from Submarine *C* 11, the jury recommended the Admiralty to consider the advisability of vessels escorting a flotilla carrying a distinctive light. The old battleship *Edinburgh*, which was for many years the turret drill ship at this port, has been towed to Spithead, where she is to be used as a target. Our superintendent, Rear-Admiral Johnston Stewart, will be succeeded by Captain Torlesse, of the warship *Inflexible*, on December 15th. Engineer Rear-Admiral Agnew, who has just reached that rank, was recently on the staff of Vice-Admiral Sir George Neville, commanding the Third and Fourth Divisions of the Home Fleet. He loses a good service pension by his promotion.

Chatham Dockyard.

Although Chatham mainly depends on repair work it cannot be said that times are bad, for an official return recently issued shows that there are now 8800 employed in the yard, exclusive of those engaged in the works department, against 7152 employed ten years ago. The Admiralty, it may be mentioned, have just made a supplementary wages grant, our programme of work being very heavy. The battleship *Venerable* has left, and the *Inflexible* and *Minotaur*, of the First Cruiser Squadron, have arrived to undergo refits, the latter, as previously stated, to be prepared for service as flagship on the China station. The battleship *Inflexible* is to be out of hand by December 22nd. The refit of the battleship *London* is well in hand and she will shortly be ready for basin trials; she is to be completed by January 22nd. The refit of the submarine depot ship *Vulcan* has been completed and she will shortly proceed to Dundee. Other vessels out of hand are the cruiser *Cressy* and the scout *Patrol*. The cruiser *Dido* is to be ready by November 27th, the battleship *Cæsar* by the 30th, the battleship *Lord Nelson* by December 1st, the cruiser *Pomone*, which is being converted into an instructional hulk, by January 1st, and the cruiser *Vindictive* by March 1st. Three new submarines of the improved "*C*" class have now been completed. "*C* 19," the third submarine built in a Royal yard, has left to join the East Coast of Scotland Flotilla. She will, however, serve with the Nore flotilla at Harwich until the Scotch flotilla proceeds to Dundee, which is to be its base. The cruiser *St. George*, which has been converted into a depot ship for destroyers, is to be commissioned about the middle of December to replace the *Tyne* in the Nore Destroyer Flotilla. The latter vessel will then go to Devonport to serve in a similar capacity. The *Dee*, having been relieved in the First Flotilla by the new ocean-going destroyer *Maori*, has been taken in hand for a refit, on completion of which she will join the Second Flotilla. It is understood that the training establishment for boy artificers, for which purpose the hulk *Tenedos* is now utilized, is at no distant date to be moved to Devonport. Lectures are the thing now that the winter season has commenced. The local branch of the Royal Navy Artificer Engineers' and Engine-room Artificers' Benevolent Fund has again started a series of scientific lectures. The first took place on October 28th at the Masonic Hall, when Engineer-Commander Goodall read a paper on the treatment and maintenance of marine boilers. There were quite a hundred artificers present in addition to several engineer officers. The two senior classes of boy artificers under training in the *Tenedos* were also invited. Other lectures arranged include "Superheated Steam," by Mr. A. White; "The internal combustion engine," by Mr. W. Durtnall, and one by Engineer-Lieutenant Phillips. The Dockyard Fitters' Association are also to have a series of lectures on reciprocating and turbine engines by Mr. J. Williams, foreman in the engineering department.

Pembroke Dockyard.

It was not found possible to launch the cruiser *Blanche* in October as originally expected, but it is confidently anticipated that she will take the water before the end of November. The contracting engineers have completed boring operations for the propeller shafting, the work having taken only three weeks, which is said to be one of the smartest performances of the kind at this yard. There is a delay with the shafts, and the firm which is making them will not be able to deliver them in time to ship them before the launch, and this will have to be done when the vessel is in dry dock. This will be the first time that such an operation will have been performed here after docking. It is also expected that the ship will be launched without a rudder, another unique event as far as Pembroke is concerned. This latter is due to the fact that the steel casting of the frame was found to be faulty owing to air-holes. An effort was made to get over the difficulty by using the casting of the *Blonde*, but that, strangely enough, was found to be similarly defective. When the *Blanche* is in the water rapid progress will be made with the *Blonde*, for the construction of which a large amount of material has arrived. The cruiser *Bellona* left on November 3rd for Devonport, carrying out her 30-hours' official steam trial on the way. All her trials were completed satisfactorily, and she returned on November 12th to be got ready for commissioning. It is expected that the refit of the destroyer *Osprey* will be completed early in December, and that the vessel will leave about the 10th to rejoin the Devonport flotilla. The destroyer *Sylvia* will then be taken in hand. The torpedo gunboat *Antelope*, which has been lying for some time past at the Motherbank, has been brought round to this yard to be prepared for service on fishery protection duties.

Messrs. Wailes, Dove & Co. (1906) Ltd.—We have been informed that Messrs. Wailes, Dove & Co.'s bitumastic covering and enamel has been used in the following vessels: *Calder Grove, Kylemhor, Crewe, Mineric, Pharos, Highland Laddie, Protesilaus, Minimbah, Kirkdale.*

Mr. J. A. Smith, M.I.N.A., has designed a new fast cruising launch for Mr. E. Martin, for use on the Norfolk Broads. Messrs. Smith & Powey, Wroxham, are the builders, and are fitting in a 4-cylinder 18-h.p. Brooke motor. The boat's dimensions are 26 ft. W.L. length by 5 ft. 6 in. beam. She is cedar-built, with a slipper stern of the "Quicksilver" type, and is to be finished in a specially good style. Messrs. Vosper & Co., Portsmouth, are building a 35-ft. light-draught cabin launch, with a 50-h.p. motor, to the order of the Crown Agents for the Colonies, from designs by James A. Smith, M.I.N.A.

Engineering and Machinery Exhibition in Manchester, 1910.—We learn that the Proprietors of "The Engineering Review" have decided to promote an Engineering and Machinery Exhibition to be held in Manchester in the autumn of 1910. A hall has been secured which is the largest outside of London, and is one of the best appointed Exhibition buildings in the Kingdom. No purely Engineering and Machinery Exhibition has been held in Manchester since 1887. Manchester is easily accessible from Scotland, the East Coast, Yorkshire and the Midlands, and the industrial character of the surrounding population ensures an attendance of interested visitors greatly in excess of what might be expected in most other centres. It is estimated that there are 8,000,000 of people within a radius of forty miles of the Manchester Royal Exchange, and a considerable proportion of this population is, of course, interested in Engineering specialties. The Exhibition is to open on October 14th and close on November 5th, 1910, and manufacturers may rest assured that the interests of Exhibitors will be in every way safeguarded, and no effort will be spared to make a great success of the enterprise. The Head Office of the Exhibition is at 16, John Dalton Street, Manchester.

THE DENNY-EDGECOMBE TORSION INDICATOR.

THE recording of the torsion of a shaft as a basis for estimating the power transmitted by it, has been used in recent years as the means for obtaining what is now termed the shaft horse-power, particularly in the case of turbine machinery, in which the ordinary methods of power indication are not applicable. A good deal of pioneer work has been effected at the works of Messrs. Denny, of Dumbarton, and considerable success has attended these efforts.

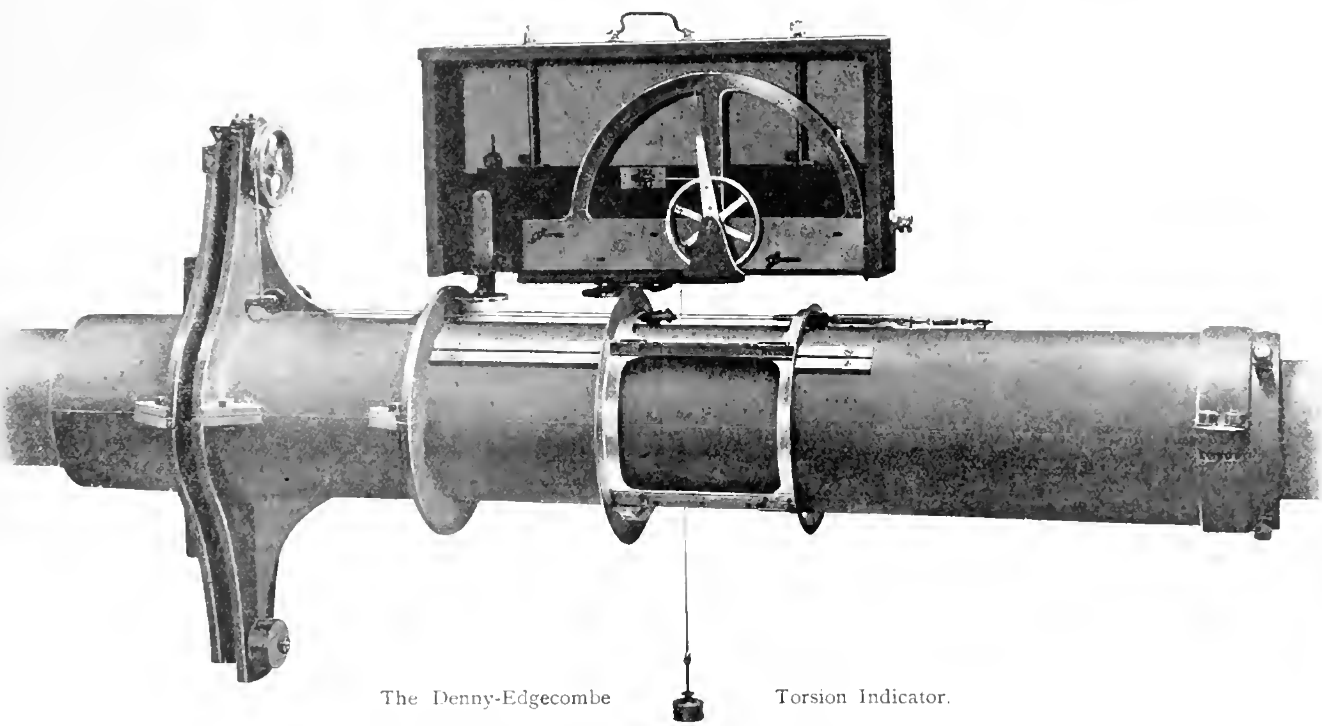
In the adjoining illustration one form of a new indicator is shown, which is being put on the market under the title of the Denny-Edgecombe Torsion Indicator.

This indicator is in the form of a simple mechanical instrument, which, as illustrated, is designed to be fitted to shafting having uniform torsion, such as steam turbines and electro motors, and shaft horse-power can be read from it at any time by any engineer in a few minutes. It has been fitted to the two new L. & Y. and L. & N. W. Railway Company's turbine steamers, *Duke of Cumberland* and *Duke of Argyll*, tested along with two other types of torsion meter on the same shaft during speed trials, and found satisfactory.

The illustration shows the instrument in its simplest form, fitted for indicating torsion at the pointer, but it can be fitted with recording apparatus, giving a diagram of power and revolutions. However, the addition of recording apparatus is not contemplated for every-day use, as the simpler pointer indication is all that is necessary.

The instrument, broadly, consists of a split tube secured upon the shaft, revolving with it, and carrying multiplying gear at the end of an arm, which gears with a quadrant on a corresponding standing arm, also secured to the shaft. By means of an endless flexible wire the torsional movement of the shaft is converted into longitudinal movement of a light aluminium traveller. This traveller has an accurately-turned flange which corresponds with an accurately-turned base flange on the tube. The longitudinal movement of the traveller flange—relatively to the base flange—is a measure of the torsion, which, when multiplied by the revolutions, gives the power measurement direct.

The indicator is applied to the flanges by means of two small revolving wheels. One of these is attached to the body of the indicator, and is kept in contact with the base flange by a flat spring. By this means the whole indicator follows any small longitudinal motion of the shaft due to thrust or expansion, and eliminates its effect from the indications. The other small revolving wheel is upon a slide on the indicator, and runs against the flange of the traveller, being kept in contact with it by a tension weight. Thus, if the two wheels be held against their respective flanges by the spring and tension weight, while the shaft is still, or being revolved very slowly, the pointer may then be adjusted to the zero position by the means provided for the purpose. When the shaft is revolving, and power being transmitted in either direction, the relative movement of the two flanges causes a corresponding movement of the pointer. All that has to be done is to multiply the reading on the scale provided for the special conditions by the revolutions per minute read at the counter. The result is the shaft horse-power.



The Denny-Edgecombe Torsion Indicator.

If the scale be divided in inches, or any fixed unit, then shaft horse-power = Reading × Rev. per min. × "K." The value of "K" varies for different shafts and instruments, and is most accurately obtained by a torsional test of the shafting before it is placed in position. A very close approximation to its value can, however, be made from many such tests of other shafts.

A light protective casing should be fitted all round the instrument except at the indicator. The indicator is carried on supports erected from the hull of the ship, or the ground. These are not shown in the illustration.

Means are provided to keep the indicator wheels clear of the flanges when not indicating torsion, so that the instrument can then be locked up, and needs no attention.

It will be recognised that by means of this instrument the engineer has ready and accurate facilities of knowing the output of power, which can be compared at frequent intervals with the steam pressures obtained on test by logging the results. It is not absolutely necessary to have the shaft specially tested for torsion, as the power can be closely obtained from the dimensions of the shafting, and in any case, day by day, comparisons will be accurate indications of the engine or motor efficiency.

SOME POINTS IN RELATION TO WEB-FRAME SHIPS.

EVERYONE connected with practical shipbuilding will admit that the web-frame system of construction has, so far as ordinary merchant steamers are concerned, almost completely fallen into desuetude. By the web-frame system is meant that well-known manner of supporting the side, which consists of plate frames spaced from four to eight frame spaces apart, with one, two or three side stringers of the same depth as the web frames, in association with ordinary frames of plain or bulb-angle or channel section, fitted transversely at the usual spacing. In one class of vessel alone is their retention a matter of general practice. In vessels intended for carrying oil in bulk we still find this system in almost exclusive use, and there are very sufficient reasons why this should be so. Modern oil ships are divided into compartments by oil-tight bulkheads fitted at an (average) interval of 30 feet, and these bulkheads, together with the longitudinal bulkhead fitted at the centre line, are supported mainly by an arrangement of vertical webs and horizontal girders. These horizontal girders are fitted in line with the side stringers, which are a feature of the web-frame system, and there is thus made possible a continuous horizontal girder right round the oil compartment, with a most efficient and rigid connection at the sides and at the centre of the ship. There are two other reasons which operate most powerfully in perpetuating this system in modern oil vessels. The first of these is that, by reason of the close spacing of the bulkheads, the plate side stringers acquire a value as supports to the side independently of the web frames, which they do not possess when the bulkheads form the divisions of the cargo holds, and are spaced 60 feet or more apart. In tanks in which the length approximates to the depth, it may be taken that, roughly, the presence of the side stringers doubles the strength of the side framing, and, when the nature of the cargo carried is taken into account, it will be evident that this excess of strength must be very welcome to both owner and designer. The second reason follows immediately from the above, and may be said to be the increased *stiffness* made possible by the web-frame system. It would, of course, be possible to design a system of ordinary uniform "deep" frames to be of equivalent strength to any given web-frame arrangement, but in tank steamers of considerable depth the question of the flexural rigidity of these long frame girders would require serious consideration, and would probably involve increase of scantling. In these two respects the web-frame system enjoys in this particular class of ship a balance of advantage which ensures its continued use. In the case of ordinary cargo ships, however, as before stated, web frames are now very seldom fitted, and it may not be out of place to consider briefly the causes which have contributed to the abandonment of a system universally admitted to be sound from a structural point of view.

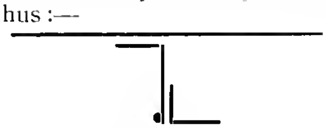
In the first place, it must be confessed that the web-frame system is an expensive one to build. The lack of uniformity characteristic of it, together with the number of pieces involved, makes this perhaps unavoidable. There is also the curtailment of capacity due to the presence of the relatively deep webs in the holds; and in some cases—in steamers for carrying chilled-beef for example—this would prove absolutely prohibitive. But there is another reason, not quite so generally recognised perhaps as the two just given, but which, in the writer's opinion, has proved more effective than both in excluding web frames from favour. This reason is in respect of scantlings, in the matter of which web-frame ships have not received just treatment from designers and others responsible. Compared with deep-frame ships—that is, ships in which the frames are of a uniform depth—the web-frame system has been handicapped by an excess of weight in the past which has been quite unnecessary, as will presently be shown.

To do this it is necessary to discuss shortly the principles on which the design of web frames should be based. The side of the vessel must withstand certain pressures from the outside water, and, in a comparative sense, its capacity to withstand these pressures, when of any assumed magnitude, is a measure of the strength of the side. Now in the case of uniform frames these pressures are transmitted by the steel plating and intercostal stringers mainly to the frames, which, being supported at top and bottom, may, without serious error, be regarded as so many beams of uniform section and of known length. Provided the assumptions made be reasonable, and the limitations of the method borne in mind, no difficulty should be experienced in arriving at a fairly exact comparative result. In the case of web-frames, however, the pressures are, as before, transmitted to the frames which, in this case, are of relatively small scantling. The frames give up their load to the plate side stringers and to the deck and bottom respectively, and that part of the load incident upon the stringers is given up to the web-frames between which the stringers are fitted. In designing a system of web-frames that is how the load should be regarded as being proportioned, and it is easy to see that the web-frames, therefore, should be regarded as having to withstand much the greater part of the external load. In actual practice it would be wise to assume that the whole of the load is to be borne by the web-frames, which should be designed accordingly, and as a matter of fact this is what is actually done. But it also follows that the side stringers fitted

should be designed to be efficient for a span equal to the distance between the webs, and that the ordinary frames should be designed to be efficient for a span equal to the distance between the side stringers. But this is exactly what has not, in the past, been done, and if the strength of these three component parts of the structure be calculated under the same assumed conditions it will be found that the side stringers and ordinary frames are much stronger than the webs, and therefore much too heavy. It will not be necessary, in order to make this plain, to make any excursion into mathematics. Let us look first at a specific case. Take web-frames 18″ deep, 8/20 in thickness, spaced 12 feet apart, with three side stringers. These webs would have a face bar attached to their inner edge of, say, $6 \times 4 \times 12/20$ ordinary angle. This according to our reasoning is sufficient to support the side for a length of 12 feet, and has been found to be sufficient to support it, the unsupported length of the web-frame being about 20 feet. Now, in the same length there are *three* stringers, of only 12 feet span, and yet these three stringers are the same depth as the web-plate, are formed of plates of the same thickness, and have an angle of the same size riveted to their inner edges. The stringers, that is to say, are of practically the same scantlings as the webs (the part slotted out for the ordinary frames does not materially affect their strength) although greater in number and of much less span. It will be quite evident that these could be substantially reduced, and that, in fact, the stringers need not be made the same depth and thickness as the webs, and if for practical reasons they are made the same depth, the necessities of the case could be met by a stringer plate of reduced thickness and flanged on the face. It should be noticed, too, that the logical result of making these stringers heavy and of fitting a heavy bar on the face, is to make provision necessary at the web frames for a continuation of the material stopped at that point. This is effected by means of large diamond plates, and thus economy is doubly sacrificed.

With regard to the ordinary bulb-angle frames the same remarks may be made. In the case we have been considering these frames would probably have been about $8 \times 3\frac{1}{2} \times 10/20$ bulb angle, which at the span equal to the distance between the stringers is altogether too strong. No doubt these frames helped the webs in some small degree, acting between the deck and bottom, but we are contending here that that is no part of their duty, and that the principle to be followed is to make the webs efficient independently of any other support, and to design the stringers and framing suitably to the distributing part they play. It is of interest to note that in the most recent publication dealing with the scantlings of cargo vessels—the new Rules of Lloyd's Register—the changes made are on the lines above indicated. The web-frames have been slightly increased in depth and the scantlings of the side stringers and framing have been reduced—the latter more substantially.

It is perhaps too much to expect that any change now made may be sufficient to re-establish web-frame ships in the builders' favour, and that being so it becomes advisable to search for some practical applications of the idea underlying the system to methods of construction now in vogue. The idea is, briefly, the formation of stations of relatively great stiffness at definite intervals, and the provision of means for distributing that stiffness over the intermediate space. Now we think that there is room for the application of this idea to ordinary methods and one that might be suggested relates to the side framing itself. In an ordinarily framed ship the frames are of a uniform depth, and two or three ordinary intercostal side stringers are usually fitted. A great deal of diversity of opinion exists as to the usefulness or necessity of these intercostal stringers, but however that may be, since they are fitted, it is advisable to get as much out of them as possible. Suppose now that every fifth frame is stiffened by a strong reversed bar on its inner edge, thus:—



made, in short, into a modified web-frame, for the virtual effect of fitting the reversed bar is to increase the depth of the frame by a little less than the flange of the bar. It will be found on examination that the ordinary intercostal side stringers are quite sufficiently rigid to transmit the extra stiffness so given to every fifth frame to the four frames lying between them. Retaining same strength, it would be quite possible to make a nett saving in weight by a general reduction in the framing that would more than counterbalance the increased cost involved by fitting and riveting the reversed frame. This would be especially so in cases of large single-deck vessels which have deep beam knees flanged, or otherwise stiffened, on the edge. The reversed bar could extend along the face of the knee, and along the upper edge of the tank bracket, and the flanges or stiffening bars usually fitted at these parts could be dispensed with.

Another part where the web-frame idea might profitably be applied is the bulkheads. These are now constructed on the same principle as the side, *i.e.*, with uniform stiffeners extending from top to bottom. If two or three webs be fitted in association with a horizontal girder (and this girder need only be designed for the distance between the webs, and need not be of the enormous dimensions one sometimes sees), a stronger bulkhead for the same weight of material will be the result. Another method would be to fit two or three vertical webs according to the breadth of the ship, extending from the deck to the tank top, and to fit the ordinary stiffeners horizontally. Each stiffener could then be graduated in size from the bottom upwards, and all of them should be designed appropriate to the distance between the webs. The stiffeners could be bracketed to the shell plating at the sides, and in this respect would be superior to the ordinary uniform vertical arrangement, in which they are bracketed to relatively flexible deck and tank-top plating. The two instances given above must suffice as examples, but it is considered that a further extension of this principle will be of benefit to builders and will not produce a worse ship. It will be found to be true that all recent improvements in construction which have proved successful have taken the direction of the concentration of material, so as to effect a saving in weight, and it is in this direction principally, perhaps, that we must look for further economies.

OBITUARY.

John G. Dobbie, Ex-Vice President, Institute of Marine Engineers.

THE death of John G. Dobbie at Tighnabruaich, Kyles of Bute, on October 21st, was received with surprised regret by a large number of marine engineers and others who have been more or less closely associated with him for many years in India and on the Clyde. He served his apprenticeship as an engineer with Messrs. Simons, Renfrew, and afterwards joined the service of the British India Steam Navigation Company as a marine engineer in 1872, and after holding appointments in the various grades to chief engineer, he was selected for the position of Assistant Superintendent at Calcutta about 1876. About thirty-two months later he was appointed Superintendent at Bombay. After serving in that capacity for about eighteen months he came home on leave. Returning to Bombay he remained there till about 1886, when he was transferred to Calcutta, where he remained as Engine Superintendent of the British India Company till 1898, when he came home and took up the duties of Resident Superintendent at Glasgow. Previous to leaving India Mr. Dobbie suffered considerably from insomnia, which he attributed to shock due to his experience while the earthquake vibration was felt in Calcutta about twelve years ago. Although somewhat ailing for some weeks previous to the fatal issue, the end was unexpected by his relatives and friends. To his widow and family we offer our respectful sympathy and regrets, as we bear in our memory kindly thoughts of past associations with him who is gone. Mr. Dobbie was elected a member of the Institute of Marine Engineers in 1890, and has been a Vice-President for several years. During his residence in India and at Glasgow he was held in much respect by those who were associated with him, unassuming in disposition, firm in his conviction of what is right and true.

Photo by Wohlgemuth & Co., Glasgow.

The Late Mr. John G. Dobbie

NOTES ON MARINE BOILER DESIGN, CONSTRUCTION AND ECONOMY.*

By Mr. D. MYLES, Vice-President.

IN preparing this paper the writer's aim is to draw the attention of the members to some modifications and improvements in the design and manufacture of boilers and economy in the consumption of coal, due to the increased pressure from about 80 lbs. per square inch to 180 lbs. or 220 lbs. per square inch ; and as there are sure to be considerable differences of opinion aud practice in these matters, he trusts there will be a good discussion, and hopes that by the exchange of ideas some useful lessons may be learned.

Amongst the important changes that have taken place in recent years have been the substitution of steel for iron in the manufacture of marine boilers, aud the more recent adoption of steel with a high tensile strength. This latter advance has been rendered possible by the improvements introduced by the steel makers, and while complimenting them on the success they have already achieved, the fact that occasional defects are found in steel plates made by the most eminent firms of steel manufacturers in the world, leaves them room for further advance in the way of providing material which will be absolutely reliable in every respect, and which will merit the confidence of engineers. The shipowners' attention is necessarily largely given to the commercial side of running the steamers, and naturally they do not wish to have to devote time to highly technical questions, such as the cause of laminations, cracks or other defects which sometimes develop in steel boiler plates.

The experience of a number of years seems to indicate that, with proper care and attention, the life of a steel boiler at the higher pressure will be quite as long as that of boilers working at the lower pressures usual when iron was the material principally used in their manufacture, but to obtain this result, boilers still require thorough cleaning and attention, and I regret that the exigencies of trade and competition compel owners to shorten time in harbour, and consequently the boilers are not so thoroughly cleaned as otherwise they would be.

Design.—Considering the improvements in boiler design during recent years, as a result of wider experience, what strikes the writer most is the great change of opinion and practice with regard to crowding a large amount of heating surface into the smallest possible boiler, thereby reducing the space for cleaning and examination and otherwise making the boiler unsatisfactory. Boilers, which a few years ago were considered large enough to contain about 2400 square feet of heating surface, are now usually made 9 inches or 12 inches larger in diameter. This extra size is due to a number of causes, the principal of which are the larger spaces between combustion chambers, between nests of tubes, and between steam space stays, thereby making the boiler much more accessible for cleaning, and as ships' engineers, together with boiler cleaners, are very human, the boiler that is not easily accessible is very liable to go improperly cleaned, and the opposite, of course, also holds good that a boiler easily accessible is much more likely to be thoroughly cleaned, and in boiler treatment cleanliness is of the very highest importance if long life and satisfactory results are to be obtained.

Another change which has gradually taken place is the increased importance which is attached to large combustion chambers. This is a change which very materially tends towards increased efficiency and economy in the working of the boilers, and it is a movement in the right direction, although, like everything else, it is possible to overdo it. This alteration is a great improvement in boilers intended to work under natural or forced draught, and has been found to be of the utmost importance in boilers intended for burning liquid fuel.

Improvements in steel works and in boiler shop plant have enabled boilermakers to use thicker plates than was customary in recent years, thus obviating the necessity of riveting on covering plates, which at one time were frequently fitted to the boiler ends and spaces between nests of tubes, thus providing the shipowner with a more satisfactory boiler, as every additional rivet hole is a possible source of trouble during the life of the boilers.

The same improvement in steel works has enabled steel makers to provide boilermakers with larger plates thus reducing the number of seams, and it is now pretty nearly a common practice for single-ended boilers, even of large dimensions, to be made in one strake of shell plates, the benefits of which are so obvious that the writer does not think it necessary to mention them.

The increase of pressure referred to in the beginning of the paper has also led to a development in manhole doors, and the flanged doors (now so frequently placed in the ends of boilers), together with the grooved manhole door, are very great improvements on the doors that were generally used in the days of lower pressures.

The use of corrugated furnaces has become more common in recent years. The advantages of these furnaces are somewhat outside the scope of this paper and have been amply insisted upon by the patentees of the various sections, but although they have proved quite satisfactory they have only a certain commercial value, and it is quite possible we may shortly renew our acquaintance with our old friend the plain furnace. The Gourlay-Stephen back end, introduced by the late Mr. Kemp, of Govan, or the Ashlin type, introduced by the late Mr. Ashlin, of Liverpool, possess advantages facilitating renewal so obvious that they have practically become universal, and the older type of furnaces flanged at the back end to take the back tube plate are now practically obsolete, as also is the practice, sometimes previously adopted, of welding the furnace to the back tube plate.

The great increase in the number of Classification Societies, due to Continental countries having in so many cases adopted rules of their own, as well as to the formation of new societies at home, has made the work of the boiler designer rather more difficult than it appears to the writer to be altogether desirable, and while the labours of the recent Standardization Committee have done a considerable amount of good in the direction of removing the differences between the various societies' rules, there is still room for further improvement in the direction of uniform tests. Materials being the same and the work required also the same, the writer fails to see why similar tests cannot be agreed upon, and while the writer values the labours of the members of the different Classification Societies, it appears to him doubtful if an adequate return is obtained for the extra expense incurred in connection with these different surveys. This expense inevitably falls on the shipowner.

Manufacture.—With regard to the manufacture of marine boilers, the higher pressure has effectually put an end to the time when, as sometimes happened, a boiler was prepared for the official test by the introduction of a little sal ammoniac in the neighbourhood of the seams of the plates, and boilers that can satisfactorily stand the working pressures general to-day have to be honestly fitted metal to metal, and the workmanship has to be beyond doubt. This severe demand on accuracy and workmanship will be admitted by those of you who remember that not so many years ago it was no unusual thing for shipyard platers, riveters and caulkers to be employed in the boiler shop. This, in the writer's experience, has now entirely ceased, and boilermakers are properly trained for the important work they have to do, and hand-caulking is now largely replaced by pneumatic caulking.

Along with the improvement in workmanship, there have been vast improvements made in machines used in the manufacture of boilers. The holes for stay tubes, which a few years ago were tapped by hand, are now almost universally accurately tapped by machine, and this applies also to stay holes between combustion chambers, boiler backs, etc., and a hole tapped by machine is more likely to be true and fair than one tapped by a man pulling at the end of a long single-ended lever, as was frequently the case in former years, and if the hole is truer the screwed stay will necessarily be a better fit.

The same remark applies to the greatly increased use of electric or pneumatic drills instead of the hand ratchet brace, and although this improvement may be also in the direction of economy in costs, the more accurate workmanship is undoubtedly in the direction of improvement in the manufacture of boilers.

The practice adopted by some builders of boring out the flanged opening in the boiler front plate for the front end of the

* Read before the North-East Coast Institution of Engineers and Shipbuilders at Newcastle-upon-Tyne, on October 29th, 1909.

furnace, appears to the writer to be a somewhat doubtful advantage. If the furnace is a good fit in the flange, a matter which does not present any great difficulty, I think there is nothing to be gained by machining the surface, but the removal of scale due to flanging and heating is necessary in all joints.

The larger boiler plates already mentioned have necessitated larger and more improved machinery in the boiler shop to handle them during the manufacture of the boiler, and also entail more careful and responsible work on the part of the workmen, with the result that boiler manufacturers are able to supply their clients with boilers which with ordinary careful treatment give less trouble than was the case when the pressures did not exceed half what they are at present.

The size of boilers which can be built nowadays is only limited by the economy in working. Double-ended boilers, working at 100 lbs. pressure per square inch, and weighing over 100 tons per boiler, have frequently been fitted with very satistactory results; in fact, some of these boilers are the most efficient that the writer has had any experience of.

The Classification Societies' rule that boilers must be tested to twice the working pressure is a relic of bygone days and ought to be deleted from the societies' rules. I do not see any objection to continuing to make the boilers capable to stand this pressure, but I consider the extra caulking necessary to prepare the boiler for this test is really detrimental to the boiler, and without any equivalent compensating benefit.

A recent improvement in combustion chamber side plates is worthy of careful consideration by all interested in marine boilers. By this improvement the wrapper plate is made all in one piece, but of different thicknesses to suit the requirements of the designer, and so saves the three-ply joints where the thick bottom plate joins the thin side plate, and which joints so frequently give trouble in actual working of the boilers.

With regard to future development, the writer does not like to attempt the rôle of a prophet, but it appears to him that while water-tube boilers are absolutely essential for certain classes of work, they, like everything else, have their limitations, and while they have overcome troubles arising from quick raising of steam, forced evaporation, etc., they bring with them defects and troubles to which the ordinary type of marine boiler is not subject, and which will restrict them to vessels for special service, and the ordinary return tube type of marine boiler has still a long and useful career before it.

The writer has always considered caulking as rather a barbarous method of making seams of boilers tight, but it is very difficult to propose a satisfactory substitute. The electric arc, oxy-acetylene, or any other method of welding has disadvantages, which at present appear fatal, but from the advances that have already been made in this direction the writer hopes that some further improvement will be made in the near future, and that a more satisfactory method of making boiler seams tight, without interfering with the movement due to expansion, will yet be discovered.

Apparatus for burning liquid fuel in marine boilers has made very great advances in recent years, and there are systems now at the disposal of engineers which, if proper care be exercised in designing and working the boilers, can be used with perfect safety as regards the life of the boiler. Liquid fuel, however, is not an unmixed blessing, and if an undue proportion of water be mixed with it, a natural and not unusual defect, the result will of necessity be unsatisfactory, and may even be disastrous. To get satisfactory results with liquid fuel the boilers should be specially designed for this purpose and it should not be attempted to build a boiler, or arrange furnace and burners to use liquid fuel or coal alternately, as satisfactory and economical results cannot be got by this attempted combination. The adoption of oil fuel will to a large extent be limited by the available supply, and I do not think that owners of collieries need have any great fear of serious competition from this source.

Mechanical stokers for marine purposes do not appear to have made any great advance. Several systems have been tried with fluctuating success, but I think it will be a long time before the properly trained fireman will be superseded.

Excepting in Canadian lake steamers, I have not heard of any attempt to arrange for self-trimming in the bunkers during the voyage, and I think this is a matter worthy of attention.

The increased technical knowledge and better training of most of our sea-going engineers has fitted them to take a more intelligent and rational interest in their boilers than was always the case in past years, and the improvement that has been made in this direction will undoubtedly continue. When one considers the history, a not uncommon case, of two steamers built at the same time, fitted with boilers by the same makers, and apparently subjected to the same treatment, one set of which has a comparatively short life—say, five or six years, while the other lasts two or three times as long, there cannot be much doubt that the longevity of boilers is principally due to the care taken by the superintendents and sea-going engineers in whose charge they are placed. At the same time, the necessity of immediately attending to any leaks that may develop cannot be too strongly impressed on sea-going engineers, as grooving very quickly starts and may soon grow to serious proportions. The responsibility of the sea-going engineer, and the advisability of dealing with his certificate in case of carelessness or neglect of duty, as is done with ship-masters, is a question worthy of consideration.

In this respect, also, the improved appliances and better accommodation now provided for firemen play an important part, and the recent move by the Board of Trade in directing attention to the ventilation of stokeholds is a very important one, provided it be carried out in such a way as not to unduly harass the shipowners and their representatives, who should certainly not be left at the mercy of the individual ideas of the surveyors at various ports. Defective ventilation in the stokehold has not infrequently been the real cause of unsatisfactory speed of the vessel, which, in the first place, was perhaps naturally attributed to a faulty propeller. This defect may also have a very important influence on economy of consumption and is sometimes the real cause of serious and justifiable complaint from the shipowner on this account.

In conclusion, the writer trusts these fragmentary remarks may suggest to the members some experience of their own, and that they will give the others the benefit of their experience.

SWANSEA HARBOUR AND DOCKS.—On November 23rd, the new King's Dock at Swansea, one of the largest of the kind in the United Kingdom, was opened. Swansea Harbour affords every convenience for the largest ships and is in a well-sheltered position. The King's Dock has been full of water for some time and the first vessel to enter was the s.s. *Lucania*, whose dimensions are, 601 feet length; 65 feet beam; 12,952 tons gross.

MOTOR EXHIBITION, OLYMPIA.—The Motor Show at Olympia this year, judging from the large number of exhibits and the attendance of visitors, has been a success in respect to these two elements, and they go far towards showing good evidence of success, in that there was plenty to see and many to see what was to be seen. There were also evidences of business done, which, from an exhibitor's point of view, is the important one—the justification of the expense involved, and, from the point of view of the visiting public, no less important, being an earnest and an expectation of future shows. The main Hall, which was nicely decorated, and the Annexe were filled with exhibits composed entirely of road vehicles, and these were extremely good and handsome, the excellent finish and the taste displayed in the fittings and appointments being pleasing to the eye, whether desirous of possession or only of feeding a taste for the beautiful. We missed the motor-boats of former years and admit to a feeling of disappointment that the roadster held complete possession of the field, a disappointment mitigated to some extent by the compensating thought that the motor carriages of the day on view proved that the British manufacturer was well to the front in respect to motor traffic. The Gallery was devoted to accessories, and many of these were extremely interesting—and convincing, as we call to mind the dimensions of the ladies' hat boxes and other gear—suggestive of both comfort and luxury. The exhibits embraced all the necessaries as well as the luxuries of the motor carriage traveller from the spirit of motion to the material substance which is controlled by it. We venture to express the hope that the motor-boat builders will be aroused to emulate the example of the motor-carriage builders and come forth to show samples of their handicraft.

THE VIBRATIONS OF SHIPS AND THE USE OF A DYNAMICAL MODEL FOR DETERMINING THE ELASTICITY OF SHIPS.

By Professor J. B. HENDERSON, D.Sc.

(*Continued from page* 140).

THE CAUSES OF VIBRATION IN SHIPS AND THEIR LOCATION BY MEANS OF PALLOGRAPH RECORDS.

A PALLOGRAPH record of the vibrations of any ship gives us information regarding the natural periods of vibration of the ship and the frequencies of revolution of the screws; but it is, as a rule, difficult to locate the exciting cause of the vibration, unless there happens to be some simple relation between the frequency of a screw and the natural frequency of the ship. This will, however, rarely happen, and the exciting cause can only be located by a process of deductive reasoning from our knowledge of all the exciting causes which may be present. Every portion of an elastic structure may vibrate with a natural period of its own, if there is a local exciting impulse of about the same frequency; but these local tremors may sometimes be the exciting cause of the ship's vibration, if the periods of the two should happen to agree.

A stretched string, as in a violin or pianoforte, will vibrate in unison with a tuning fork of the same frequency sounded in its neighbourhood. It will also vibrate in unison with a tuning fork of double, treble, or n times that frequency, the string then having 1, 2, 3 or n nodes in its length. A bar, however, while it will vibrate in unison with a tuning fork having the same frequency as the bar, will not vibrate *in unison* with tuning forks having the harmonic frequencies. The reason for this lies in the fact that the frequencies of vibration of a string in its different modes are in the simple ratios 1, 2, 3 . . . n, while those of a uniform free bar are approximately in the ratios of the squares of the odd numbers 3^2, 5^2, 7^2, etc. The frequencies of vibration of a structure such as a ship in its different modes cannot possibly follow a simple rule, and cannot be calculated; but the vibrations having been excited in the ship and recorded on the pallograph, it lies with us to analyse all the exciting impulses, and to find out which of these has a harmonic having the same frequency as the vibration.

The idea of analysing an impulse may be new to some. If a periodic impulse is due to, say, a rotating crank-shaft out of balance, it is of sine form, and has no harmonics; but if the periodic impulse is of the hammer-blow type, it is very rich in harmonics, and can, by Fourier's analysis, be analysed into a series of sine impulses whose frequencies are in the ratios 1, 2, 3 . . . n. Thus a periodic hammer blow is equivalent to a series of shafts out of balance revolving at frequencies 1, 2, . . . n times the frequency of the hammer blow. It is evident, then, that, although the frequency of the blow may not agree with the natural frequency of the ship, the frequency of one of the harmonics may agree with it.

The various periodic impulses which are applied to a ship may be summarised as follows:—(1) Inertia forces due to reciprocating masses in the main engines or auxiliaries. (2) Inertia forces due to want of balance in the rotating masses. (3) Longitudinal or transverse vibration of any portion of the ship's structure due to a local exciting cause, such as the longitudinal vibration of the mast when used for a boat hoist or derrick, the whirling of a shaft, etc. (4) The reactions on the ship corresponding to the periodic pulsations of speed in the crank shaft. (5) Insufficient clearance between the blades of the screw and the ship's side or A bracket, so that the flow of water to the blade nearest the ship is restricted, and the torque thereby reduced. The torque is then unsymmetrically applied to the propeller, with the result that there is a reaction on the propeller bracket or stern tube. In the case of a single screw, this reaction would be in the horizontal plane, and would tend to excite horizontal vibrations; but in the case of multiple screws the reaction would generally be in a plane inclined to the vertical, and would tend to excite both horizontal and vertical vibrations. (This reaction, if due to horizontal "spectacle" brackets would be vertical). (6) With multiple screws running at different speeds, the fundamentals or harmonics in the impulses under heading (5) will periodically "beat," corresponding to the beats in music when two notes, slightly out of tune, are sounded together. These beats may give rise to low-frequency vibrations. (7) Sea-waves.

The vibrations due to rotating or reciprocating masses out of balance would, as a rule, be easily recognisable by the agreement of the periods. The impulses to which such masses give rise will be almost simple harmonic in character, and will be of the frequency of revolution, or double that frequency in the case of the inertia reactions of the connecting rods. The impulses under heading (4) could be obtained by an analysis of the crank-effort diagram, and it may be noted in carrying out such an analysis that any impulse which is symmetrically positive and negative when plotted as a function of time can have no even harmonics. The graphic method of analysis is very easily carried out.

Under heading (3) will fall all vibrations due to the natural vibration of the tail shaft. We have seen that this shaft is subjected to periodic pulsations every time a propeller blade passes close to the ship; hence, if this frequency corresponds with the frequency of lateral vibrations of the tail shaft loaded with the propeller, the shaft will vibrate very considerably. The natural period of vibration of the loaded shaft is its period of whirling, which is easily calculated. Hence a shaft with a three-bladed propeller will vibrate considerably when revolving at one-third of its whirling speed, and with a four-bladed propeller at one-fourth of its whirling speed. In analysing vibrations it will, therefore, be advisable to calculate the whirling speeds of the tail shafts. Under heading (4) we should also have to consider the natural period of vibration of each bracket loaded as it is with the propeller and a portion of the tail shaft. Since it is subjected to the same periodic pulsations as the propeller, it will vibrate considerably if these pulsations correspond with its now natural frequency. There may be other portions of the structure round the stern which are also capable of vibrating in unison with these impulses, but the calculation of their natural periods would not be easy.

Let us now apply these considerations to an actual case. The writer is indebted to Mr. W. J. Luke for a pallograph record of the *Lusitania*. The record shows intermittent vibrations of small amplitude both of low and high frequencies, but during one experiment while the ship was turning, the low frequency vibration was of considerable amplitude, and was well sustained for over a minute. A portion of this record is reproduced in Fig. 3. There must have been during that interval of time a periodic pulsation corresponding with the fundamental frequency of the ship's structure. This pulsation could only arise from the propellers, since the ship is turbine driven. Careful measurement of the pallograph record gives the following data:—

FREQUENCY OF VERTICAL VIBRATION OF SHIP = 64·1 PER MINUTE.

	Revolutions per Minute.	Frequency of Propeller Blade Impulses
Propeller No. (1)	145·5	436·5
,, ,, (2)	161·2	483·6
,, ,, (3)	143	429
,, ,, (4)	152·2	456·6

The frequency of propeller blade impulse is about seven times the frequency we are looking for, and if it were exactly seven times we might conclude that we had located the cause, because any impulse whose frequency is an odd harmonic of the natural frequency of the bar will excite the fundamental vibrations in the bar. For, if we consider the fundamental and, say, the third harmonic, their relationship is shown in Fig. 4; and it will be noticed that, during each half period of the fundamental, there is an odd impulse in the third harmonic, and these odd impulses being alternately positive and negative are just so timed as to excite the fundamental vibration. Of course, if the bar could vibrate in unison with this third harmonic impulse, it would do so; but, since it cannot, it vibrates in its fundamental mode. Any even harmonic impulse has the same number of positive and negative impulses in each half period of the fundamental, and it cannot, therefore, excite the fundamental vibration.

We see that the agreement between the fundamental propeller impulse and the seventh harmonic of the vibration frequency is not sufficiently close to account for the large amplitude of vibration, therefore we must look elsewhere for the cause. Let us examine the "beats" between the impulses of the four screws.

The bottom line of the table contains the frequency of the odd harmonics of the vibration frequency, and any impulse having the same frequency as one of these harmonics will help to excite the fundamental vibration in question. Let

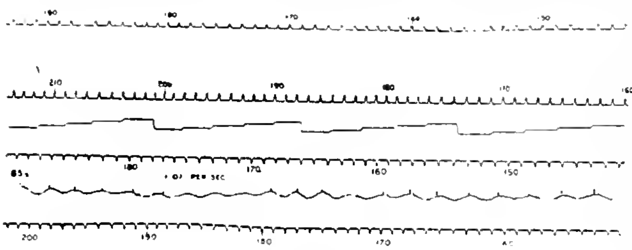


Fig. 3

us compare these numbers with those in the table above them. We find no absolute agreement, but we find several which are sufficiently close to account for a vibration lasting, say, a quarter of a minute. Thus we have—

64 and	60 beating	4	times per minute.
192 ,,	188 ,,	4	,, ,,
192 ,,	189 ,,	3	,, ,,
192 ,,	193 ,,	1	,, ,,

It is probably the last two which are the predominant factors in exciting the vibrations, namely, the seventh harmonics in the propeller impulses of screws 2, 3 and 4.

FREQUENCY OF BEATS BETWEEN THE VARIOUS HARMONICS OF THE PROPELLER IMPULSES.

	Harmonics.						
	Fundamental.	2	3	4	5	6	7
Propellers 1 and 2..	47·1	94·2	141	188	235	283	330
,, 1 ,, 3..	7·5	15	22	30	37	45	52
,, 1 ,, 4..	20·1	40·2	60	80	100	120	141
,, 2 ,, 3..	54·6	100·2	165	218	273	327	382
,, 2 ,, 4..	27	54	81	108	135	162	189
,, 3 ,, 4..	27·6	55	83	110	138	165	193
Frequency of the odd harmonics of the vibration	64.1	—	192	—	320	—	449

Almost every part of the pallograph record shows intermittent vertical vibrations of a much higher frequency and of small amplitude. Selecting a portion of the record where they lasted for five seconds, we find 41·5 periods in five seconds, *i.e.*, a frequency of 8·3 per second, or 498 per minute. The corresponding frequencies of revolution of the screw, were :—

	Revolutions per Minute.	Frequency of Propeller Blade Impulses.
Propeller 1	167	501
,, 2	164	492
,, 3	158	574
,, 4	166	498

It is evident that this vibration is directly due to the propeller impulses, since the frequencies agree, and the intermittent character of the vibration must be due to the interference of the impulses from the four screws. If all four screws rotated in the same phase and at the same speed, this vibration would be greatly magnified. At certain times they will all rotate in the same phase, and then the vibration will be a maximum, but this cannot last for more than a few seconds unless the speeds of revolutions are all equal. That these are forced vibrations is evident from the fact that they occur with the same frequency in the record of horizontal vibrations. This record shows these vibrations very angular in character, such as we would expect in forced vibrations, and the approximate sine form of the corresponding vertical vibrations may be accounted for by the frequency agreeing more closely with one of the natural frequencies of vertical vibration than with one of the horizontal frequencies. By varying the speed of the screws these natural frequencies could all be obtained.

In one of the *Mauretania's* pallograph records which the writer has examined, there is a very pronounced intermittent vibration in both the vertical and horizontal planes, of frequency 9·7 per second, or 582 per minute. The screws were running at 193, 194, 193·2 and 194·5 revolutions per minute, and the frequencies of blade impulses were 579, 582, 579·6 and 583·5, so that these vibrations are undoubtedly forced vibrations due to the propeller impulses.

The same record shows intermittently a low frequency horizontal vibration of 6 periods in 4·25 seconds, or 84 per minute, lasting for 10 or 15 seconds at a time. From its sine form we conclude that it is a natural period of horizontal vibration of the ship. If, as in the *Lusitania*, we try the beats, we see that the highest frequency of beats in the fundamental is only 4·5 per minute, hence we should have to go to the 18th harmonic to get a frequency of 84. We must therefore look elsewhere for the exciting cause. It will be noticed that the seventh harmonic of the vibration would have a frequency of 588 per minute, which is very near the frequency of the propeller blade impulse, and so we have here a case of a periodic impulse exciting vibrations of one-seventh the frequency.

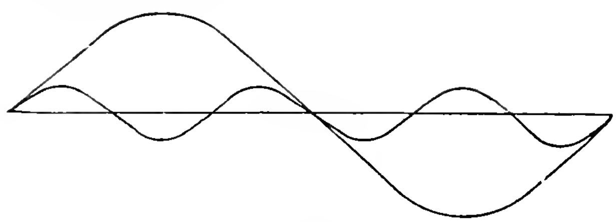


Fig. 4

We have thus accounted satisfactorily for all the vibrations of any magnitude which are measurable on the pallograph records of these two ships. The intermittent absence of vibration in this or any other screw steamer must not be attributed to the absence of periodic impulses, but simply to the interference of the periodic disturbances due to the several screws.

REVIEWS.

Applied Mechanics. By David Allan Low. Wh. Sc., M.I.Mech.E. 7s. 6d. Longmans, Green & Co., London.

THE subject of applied mechanics covers a very wide field, and it is not possible to cover the ground adequately in a single volume. The present work is a volume of moderate dimensions, covering material which is expressed very clearly and concisely. The author gives a number of exercises at the end of each chapter. The illustrations are very numerous and have been prepared especially for this work, and the text is in close proximity to them. The majority of the exercises involve numerical answers which will be found at the end of the book, and useful for those students who may be studying the book privately. We see that the author seeks to anticipate the various trigonometrical and algebraical formulæ with a definition of differential and integral calculus, such as he may use in investigations in his work, so that the student finds such a collection of results here as will serve to explain the statements made by the author involving such algebraical and trigonometrical functions. The principles of motion, force, work and energy are well and tersely set out, with the polygon of forces clearly explained. After dealing with moments and centroids and simple strains and stresses, we come to a chapter on beams and bending, which includes

the deflection of beams and the consideration of compound strains and stresses and the details of columns and struts. This clears the ground, so as to consider roofs and roof trusses, in which many examples of roof trusses and their details have been supplied by Mr. E. H. Salmon, B.Sc. (London). This chapter is followed by instances of rolled joists with channels and plates, and is followed by a chapter which deals with open web or braced girders which is well set out in detail. A good deal of attention is given to the friction of screws, of pivots and collars, and the friction of a band on a pulley. Chapters on velocity and acceleration are given, in which the acceleration of a piston or slider and connecting rod receive full consideration. Governors, brakes and dynamometers are well treated, and belt rope and chain gearing are fully discussed. The chapters on hydrostatics and hydraulics are very fairly considered, the diagrams being diffuse and well devised. The book concludes with special chapters upon water-wheels, turbines and pumps, in which the diagrams are numerous and excellent, likewise the explanatory text. This is an excellent book for the student in applied mechanics.

A Manual of Elementary Seamanship. Comm. D. Wilson Barker, R.N.R. 6s. Charles Griffin & Co., Ltd., London.

THE 5th edition of this book has been revised and brought up-to-date. It includes a copy of the last Rules of the Road which have to be learnt by heart for the Board of Trade examinations. It is a very readable book, without mechanics or special mathematics. It is an elementary manual of seamanship, commencing with a clear drawing in section of a hull from which all the seafaring names of each part are given. Afterwards a full detailed view of a ship is given, showing all the masts, spars, sails and rigging from which a long series of names are supplied. A series of illustrations of all forms of knots, hitches, bends and clinches, with a full description of each is given, and splicing is fully detailed, with numerous illustrations. Bullivant's rigging screws and rope-end fittings, are fully illustrated. Part III. gives full particulars of running gear, with an illustration of the fore part of a main sail, in which all the running gear is detailed. Tackles and purchases are described and illustrated, so that the student can know and distinguish all the well-known tackles. In Part IV. the necessary information is given as to the mode and method of refitting rigging at sea, and anchors and cables are both illustrated and described, with instructions as to laying out an anchor. This part is continued with information as to sail making, bending and unbending sails, and the details of sending up a top-mast, top-gallant mast and the like. A special chapter is given to fore and aft sailing, with illustrations of various fore and aft-rigged yachts, with a good description of how to handle boats under sail. Accidents to sails and spars are given and excellent information is provided as to how to act at such times. In Part V. we find the "rule of the road," with signals and signalling, the rules concerning lights, including signals of distress, being fully given. In Part VI. we have most of the mechanical parts of winches, capstans, etc., fully explained and illustrated. In part VII. we find a miscellaneous collection of information as to the duties of junior officers with points of etiquette in keeping and relieving watches, and, finally, useful tables consisting of French measures of length, surface, capacity and weights are given, with an extended glossary of sea terms and phrases. The illustrations are good. There are twenty-four plates and sixty-three illustrations in the text.

Steel Ships, their Construction and Maintenance. By Thomas Walton. 4th edition. Price 18s. nett. Charles Griffin & Co., Ltd., London.

THAT this is the 4th edition speaks wonderfully well of the character of this work and its adaptability to readers of many classes. We reviewed the first edition in our issue of October, 1901, and in that notice we attributed to Mr. Walton's great success in his first work "Know your own ship," and its favourable reception, the present work, which was a development of the former handbook and was intended to take us further along the road. The "plan of the book" is again repeated in this edition, which serves well to show how the author has endeavoured to arrange his task. Beginning by a condensed description of the processes of manufacture of steel and iron, which the author is well qualified to do, having spent some two years in the study of the art in Cleveland, he next describes the strengths and qualities of ship steel and iron which should be found in the finished material and the usual tests by which these qualities can be ascertained. Having next explained what the term "classed" really means, and the work of those societies empowered to assign load lines, he next embarks upon the general introduction and examination of the principles of ship construction, and deals with the various forces exerted upon the hulls of ships, tending to strain them and produce deformation. In giving the principles of ship construction the author details quite a number of special vessels, such as the *Lusitania* and *Mauretania*, the *Campania* and the *Lucania*. In Section III. of this chapter a graphic description is given of the Isherwood system of longitudinal framing, which is fully illustrated by excellent drawings showing the shell expansion of the system, a cross section, and a perspective view of a hold fitted with this longitudinal system of framing. In the two final chapters the author gives details of the construction and combination generally of the various parts which go to make up the whole ship structure, and in his last chapter VIII. he describes carefully the causes of decay and deterioration in a vessel, particularly noting those parts liable to rapid corrosion, and gives full details of what must be done to combat the causes of such corrosion, and of preserving and maintaining the structure in a state of efficiency. The volume is full of illustrations in the text and these and the plates are excellently done.

BOOKS RECEIVED.

The Mechanical World Electrical Pocket Book for 1910. Price 6d. nett. Emmott & Co., Ltd., Manchester.

The Mechanical World Pocket Diary and Year Book for 1910. Price 6d. nett. Emmott & Co., Ltd., Manchester.

Practical Testing of Electrical Machines. By Leonard Oulton, A.M.I.E.E., and Norman J. Wilson, M.I.E.E. Price 4s. 6d. nett. Whittaker & Co., London, E.C.

CATALOGUES.

Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—We have received illustrated catalogues of their continuous current "Castle" motors and dynamos, and of the electrical switch gear the firm manufactures. The catalogues are well illustrated on art paper.

Central Engine Works, West Hartlepool, have sent us their new and much enlarged edition of the drop forgings' section of their general catalogue. It is illustrated and contains a price list and detailed dimensions of various articles are given to assist the buyer.

Messrs. Siebe, Gorman & Co., Ltd.—We have received from Messrs. Siebe, Gorman & Co., Ltd., a volume published by them and called "A Diving Manual." It has been compiled and edited by Mr. R. H. Davis, their managing director. It embodies the latest deep sea practice adopted by the British Admiralty and includes chapters on physics and physiology of diving and an account of the evolution of the diving dress, diving bell and instructions for divers. There are chapters also on the duties of those in charge of diving operations, tables of times to be allowed on the bottom, salvage operations and submarine signalling apparatus. In view of the questions recently asked in the House of Commons with regard to means provided for enabling men to escape from disabled submarine boats, the chapter on life-saving devices in submarine boats is interesting, and illustrations are shown of the device. There are 184 pages between the covers, the book is full of illustrations, all excellently done, and is well worthy of perusal.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

WHILE a fair amount of fresh contracts for mercantile tonnage falls to be recorded as having been contracted for by Clyde shipbuilders since writing last month's notes, the feature again is the naval work secured. This includes orders for two second-class cruisers and one battleship of the "Dreadnought" class. Probably at no previous period has the Clyde ever had such a large proportion of naval, as compared with mercantile, shipbuilding under way. A total of twenty-seven vessels for the British Government—all, with one exception, at or above Dumbarton—with, in addition, several Brazilian destroyers at Scotstoun, is a noteworthy condition of affairs. There are now two "Dreadnoughts" and five of the "Bristol" and "improved Bristol" type of cruisers under construction, and with the twenty destroyers well distributed, employment is now fairly good all over. About 75,000 tons displacement of warship work, distributed over twenty-seven vessels, gives an average of 2,770 tons each, and means a great deal when the character of the tonnage is considered.

Messrs. John Brown & Co., Clydebank, are easily first in importance as regards the record of fresh shipbuilding and engineering contracts secured since last month's notes were penned. The item of greatest moment is a "contingent" battleship of the "Dreadnought" class. Another naval item is the contract to supply the turbine engines for the "improved Bristol" cruiser, which has been ordered from the London and Glasgow Shipbuilding Co., Ltd., Govan. In the line of mercantile shipping a fresh contract entrusted to the Clydebank firm is that for a turbine Channel steamer for service in the Harwich—Hook of Holland route to the Continent of the Great Eastern Railway Company. The new vessel will be based upon and an improved *Munich* and *Copenhagen*, built at Clydebank last year for the same service. She will be slightly larger, her accommodation for passengers will be improved in the light of experience with her predecessors, and she will be ready for her station early in the summer of next year.

Messrs. William Beardmore & Co., Ltd., of Dalmuir, launched on October 28th the second-class cruiser *Gloucester*, sister ship to the *Glasgow*, launched about a month previously from Fairfield. The *Gloucester* is the second warship constructed by the firm since they started operations in their present huge establishment, the first being the battleship *Agamemnon*. Simultaneously with the consignment of the new cruiser to the water official information came of the Beardmore Company being the successful tenderers for one of the "improved Bristol" type of cruisers. Although the tonnage is small—less than 5,000 tons gross—a considerable amount of work is involved and the order is heartily welcomed in a district which has been severely hit by the depression of the past two years.

The London and Glasgow Shipbuilding Co., Govan, about the close of October received an order from the British Admiralty for a second-class cruiser of the "improved Bristol" type, of the same dimensions and tonnage as that ordered, as above stated, from Messrs. William Beardmore & Co., Dalmuir. Very little work is at present on the stocks at this establishment, which is the highest up of all the Clyde shipyards, but the Company are not without hopes of important work coming forward. They have, it is understood, leased a portion of the vacant shipyard adjoining, formerly and for long occupied by Messrs. Robert Napier & Sons.

The Fairfield Shipbuilding and Engineering Co., Govan, is again at the high pitch of activity which, prior to the recent long spell of slackness, almost always characterized it. Since last month's notes were penned the Company have sent into the water three important vessels, representative of the varied class of productions for which the establishment is famed. On October 25th they launched the twin-screw steamer *Mecklenburg*, the third of the three Channel steamers which they have built for the Zeeland Steamship Co. for the night service between Flushing and Queenborough. The first of the trio, the *Prinses Juliana*, attained very gratifying results on her speed trials and similar success is anticipated for the two sister ships. On November 12th the Company released from the ways, in the twin-screw steamer *Balmoral Castle*, a handsome addition to the extensive fleet of the Union Castle Mail Steamship Co., which, with her sister ship *Edinburgh Castle*, presently under construction at Belfast, will be the largest and most powerful vessels employed in the South African trade. The dimensions are :—Length over all, 590 feet 9 inches; breadth, extreme, 64 feet 6 inches; depth, moulded, 42 feet 6 inches; gross tonnage, 13,000; indicated horse power, 12,500. The third vessel sent off the stocks was the torpedo-boat destroyer *Grasshopper*, the first of six similar craft the Company have on hand for the British Admiralty. The succeeding vessels are to be called *Mosquito, Scorpion, Camelon, Comet* and *Goldfinch*. Two other destroyers are also building in the yard for the Australian Commonwealth Government, one of which will be shipped in sections to Australia for re-erection there and the other will go out under her own steam. A third destroyer for Australia is being built by Messrs. Wm. Denny & Brothers, Dumbarton.

Messrs. Yarrow & Co., Scotstoun.—This firm launched on October 27th the *Santa Catharian*, the eighth of the ten torpedo destroyers for the Brazilian Navy on which they have been busy—along with other work of a miscellaneous character—almost since the start of operations in their new Clyde establishment. The two remaining destroyers on the stocks—the *Parana* and the *Sergipe*—are expected to be launched before the end of the year. The Yarrow yard will then be empty, but although the firm have not participated in the work recently given out by our Admiralty, there is every likelihood of important fresh orders soon being secured.

Messrs. Napier & Miller, Old Kilpatrick, have received from The Buchanan Steamers, Ltd., Glasgow, an order for a new saloon passenger paddle steamer for service on the Clyde. She will be 215 feet long, 25 feet beam, and 8 feet 6 inches deep. Engines and boilers to give the steamer a high rate of speed will be supplied by Messrs. A. & J. Inglis, of Warroch Street, Glasgow.

Messrs. Fleming & Ferguson, Paisley, have secured an order to build and engine a steam yacht for Lord Blythswood, of Blythswood.

Messrs. Ferguson Brothers, Port Glasgow, have contracted to build for Japanese owners a powerful hopper dredger, which is intended for work in the great basin at Dalny, near Port Arthur, which was constructed by Russia. The vessel will be capable of lifting 1,000 tons of spoil per hour from a depth of 45 feet. It has been reported also that the firm have secured an order for a dredger of similar capability for owners in South America, but this lacks confirmation.

Messrs. Russell & Co., Port Glasgow, who recently launched a large meat-carrying steamer for the same owners, have contracted to build three similar steamers for Messrs. H. and W. Nelson (Limited), of Liverpool. The new vessels will be about 415 feet long and will be insulated throughout and otherwise specially equipped for meat-carrying purposes. The firm have also contracted to build for Messrs. James D. Dunn & Co., Glasgow, a cargo steamer of 7,600 tons deadweight carrying capacity, to attain a speed of 10 knots. Engines for all these steamers will probably be supplied by firms in Greenock and Port Glasgow, Messrs. Russell & Co. not being themselves engineers.

Messrs. Wm. Hamilton & Co., Port Glasgow, have secured an order for a passenger and cargo steamer of fair dimensions. All their berths are at the moment occupied, the whole of the eight vessels being on the Isherwood longitudinal system. It has been rumoured that the firm are in the running for one of the new floating docks required by the Admiralty. Should the order be secured it is believed that the firm will take a lease of a vacant yard in the neighbourhood, partly on account of the fact that the dock would require to be launched broadside on.

Messrs. Caird & Co., Greenock, as hinted in last month's notes, have definitely received orders for two high-class ocean steamships. These are for the Peninsular & Oriental Company, being improvements on the Company's *Malwa*, and a third sister ship is to be constructed by Messrs. Harland and Wolff, Belfast.

Messrs. George Brown & Co., Greenock, who early in November launched a grab dredger for Ballina Harbour

Commissioners, also about the same time booked an order to construct the hulls of three small steamers, which, when completed, will be shipped to India.

Greenock and Grangemouth Dockyard Co.—For the Anglo-American Oil Company this firm are to build an oil-carrying steamer, somewhat similar to one completed some time ago for the same Company. She will be 258 feet long, 40 feet 6 inches beam, 21 feet deep, and will have carrying capacity for 2,150 tons of oil. Triple-expansion engines and two large boilers will be supplied by Messrs. John Kincaid and Co., Greenock.

Messrs. Ramage & Ferguson, Leith, at the latter end of October booked an order for a fast coasting steamer for Messrs. John Weatherell & Sons, Dublin.

The Caledon Shipbuilding Co., Dundee, have been commissioned by The London & Edinburgh Shipping Co. to build and engine a screw steamer for their passenger and cargo service between Leith and London. The new vessel, which will be of 1,800 tons, will be similar in arrangement to the *Fiona*, built by the Caledon Co. in 1905. She will be 300 feet in length and her speed on service will be 17½ knots. As further evidencing the development taking place in the East Coast seaborne traffic it may be mentioned that the Carron Co. will shortly be supplied with a new steamer, which has been built by Scott's Company, Greenock, and that the Dundee & London Shipping Co. is also in the market for a new steamer.

THE TYNE AND WEAR.

(From our Own Correspondent.)

Messrs. Swan, Hunter & Wigham Richardson, Ltd., have had the s.s. *Salvador* out for her trials. Her machinery worked very smoothly and the vessel developed a speed of 12½ knots. The propelling machinery has been built by the Company. The *Tortona*, built for the Cairn Line of Steamships, Ltd., of Newcastle, ran her trials and a speed of 15 knots was developed. Her engines are by the Palmer Shipbuilding and Iron Co. Ltd., of Jarrow. On Nov. 6th the *Natalia* ran her trials, the engines working satisfactorily; a speed of 12 knots was obtained. Her triple-expansion engines and boilers have been built by Messrs. Swan, Hunter & Wigham Richardson, Ltd. The s.s. *City of Colombo*, a large cargo vessel carrying 9050 tons deadweight, is now being completed and will shortly go on trial. The keel of the new Cunarder, 622 ft. by 71 ft., has been laid. The floors are being erected and the framing will soon be in full swing. A Canadian passenger vessel is nearly ready for launching, and a sister ship is being framed. The dry docks and repairing department are very busy.

The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne recently had the s.s. *Gerania* out for a loaded trial trip which was in every way satisfactory. She has been built for D. Tripcovich, Esq., of Trieste, and is the fourth vessel built by this company for him. She is 402 ft. long, 52 ft. 6 in. beam, 29 ft. 8 in. depth. The *Queen Maud*, *Parisiana* and *Netherpark* have also run their trial trips, in each case satisfactorily.

Messrs. Wm. Doxford & Sons, Ltd., have launched from their yard a large single-deck vessel built for Messrs. W. J. Tatem & Co., of Cardiff. She is 378 ft. long 51½ ft. beam and 30¼ ft. moulded depth. Messrs. Doxford are also building the engines and boilers.

Messrs. Short Bros., Ltd., have launched from Pallion the *Cacique*, built for Grace Bros., Ltd., of New York and London. Length, 410 ft.; breadth, 52 ft. 4 in.; depth moulded, 29 ft. 1½ in., and designed to carry 8250 tons deadweight on moderate draught.

The Sunderland Shipbuilding Co. had the *Germaine* out recently for a loaded trial trip, when a mean speed of 10½ knots per hour was obtained.

Messrs. John Readhead & Sons, Ltd., have sent the *Treveal* for her trails, her machinery worked smoothly and every satisfaction was given.

The North-Eastern Marine Engineering Co., Ltd., have supplied the powerful machinery of the s.s. *Gerania* built by The Northumberland Shipbuilding Co., Ltd. and for the s.s.'s *Queen Maud* and *Cacique*, recently launched by The Northumberland Shipbuilding Co., Ltd., and Messrs. Short Bros., Ltd., respectively. The engines of the *Germaine* are also by this company.

Palmer's Shipbuilding and Iron Co., Ltd., have supplied the machinery of the *Tortona* and *Parisiana*. Both of the vessels have recently run satisfactory trials.

Messrs. S. P. Austin & Son, Sunderland, are at work on a new vessel to be launched in the early part of December. With respect to repair work, they have a large vessel on the pontoon undergoing repairs necessitated by collision with a trawler in the North Sea. They have also the t.s. passenger steamer *Venus*, owned by the Lloyd Brazileiro of Rio de Janeiro, in their yard for examination of extensive damage and repair. They have other repairing work in prospect.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, are reported to have secured the contract to build two large cargo steamers, and are now well supplied with work for well into next year.

Messrs. W. Harkess & Co. have secured the contract for a small steamer for delivery about March.

There is every probability of the Dundee, Perth and London Steamship Co. placing an order locally for a large passenger and cargo steamer, but the competition I hear is very keen and prices low.

The Tees Furnaces have recently dismantled three furnaces and are busy erecting two larger furnaces for more economic production and suitability.

Mr. I. Isherwood, the inventor of the Isherwood system of the longitudinal construction of steamers, has opened offices at Exchange Buildings with a large and efficient staff to deal with the numerous enquiries relative to his invention.

Messrs. Richardsons, Westgarth & Co., Ltd., are now fairly busy and during the month have secured the contract to engine and boiler a steamer building locally. They are also busy in the boiler (Nestdrum) department and have some general engineering work on hand.

Messrs. Smiths' Dry Dock Co. have launched their last steamer built at Shields, and the yard will now be converted into a large dry dock. At Middlesbrough they have ten contracts on hand for tugs, trawlers and small cargo boats, which will keep them busy into next year.

Stockton and Thornaby.

Messrs. R. Ropner & Son are about to lay down the keel for a cargo steamer required for early delivery; the machinery it is reported, will be supplied by Messrs. Blair & Co., also of Stockton.

Messrs. Craig, Taylor & Co.'s yard is looking busier than it has done for some time and they are reported to have secured the contract to build a cargo steamer for early delivery.

Messrs. Blair & Co. are reported to have secured the contract to supply the engine and boilers for a cargo boat to be built by Messrs. Dobson & Co., of Newcastle-on-Tyne, for Messrs. Nye Clare & Co. of London.

West Hartlepool.

Messrs. W. Gray & Co., Ltd., have secured the contract to build two large cargo steamers for Messrs. F. Strick & Co., London, the machinery being supplied by their Central Marine Engine Works. This firm are only fairly employed, as, having fourteen berths in their two yards, they require a large amount of work to make them busy. They are reported to have secured the contract to repair the steamer *Lesreaulx*, of 3,000 tons, belonging to Messrs. Morel, Ltd., of Cardiff, which recently went bow on to the quay wall at Queen Alexandra Dock; the stern is smashed in and both bows badly damaged.

Messrs. Irvine's Dry Dock and Shipbuilding Co., Harbour Yard, keep well employed with work, and are reported to have secured the contract to build a cargo and passenger steamer for Messrs. The Tyne Tees Steamship Co. She is to be an improvement on the *Teessider*, which has given such excellent results. She will be about 270 feet long, 37 feet beam, 17 feet 6 in. draught, and have accommodation for over 300 passengers, and has to maintain 14 knots on service. They have also been busy in the dry dock, several vessels having been overhauled and repaired.

Hartlepool.

Messrs. Richardsons, Westgarth & Co. are now fairly busy. They have secured the contract to fit the machinery to the new Tyne Tees Steamer to be built by Messrs. Irvine's Dry Dock Co., Ltd. It is rumoured that she will be christened the s.s. *Stephen Furness*, after one of the Directors of Messrs. Furness, Withy & Co. and other local firms. She will be supplied with engines and boilers of about 2,500 I.H.P., fitted with Messrs. Howden's System of Forced Draught, sufficient to maintain 14 knots on service. They have also received the order to supply the machinery for a large cargo boat to be built by Messrs. Irvine's Shipbuilding and Dry Dock Co. at their Middleton yard. Besides a large amount of general engineering work, they are busy with a large contract to supply three sets of condensing plants for Thorne Colliery, near Doncaster, for Messrs. Pease Partners.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Middleton, have secured the contract to build a large cargo steamer of about 6,500 tons deadweight for Messrs. Woods, Tyler and Brown, of London, for delivery about May, and with the amount of work on hand may now be said to be fairly busy. Still there is room for improvement everywhere locally. The London steamer s.s. *Kalomo*, which went ashore off Singapore at the back end of last year, is now in dry dock undergoing extensive repair; she is owned by the Bucknall Line.

THE HUMBER AND DISTRICT.

(*From our Own Correspondent.*)

We much regret to report the death of Mr. Arthur Wilson, J.P., D.L., of the Wilson Line of Steamers. The house flag of the line is known in every seaport throughout the world. Mr. Wilson was a Director on the Board of the North-Eastern Railway Coy., and filled the chair as High Sheriff of his native city in the year 1888, and his advice on matters appertaining to Docks, Shipping, etc., and to the city generally, was much sought after. He was an admirable Yorkshire gentleman, and took a great interest in charitable institutions, and was always ready to alleviate the sufferings of the poor. On one occasion, being appealed to for a donation to a Children's Hospital, he subscribed £1,000 and later gave another £1,000. He was buried at Kirkella, close to Hull, his remains were taken on one of his draped rullys drawn by farm horses. The service at Hull Trinity Church was conducted by Bishop Blount and was attended by the Mayor and Corporation, Trinity House Brethren, Officers of the Wilson Line, and many others. The Church was filled to overflowing.

Earle's Shipbuilding and Engineering Co., Ltd., have received an order from N.E.Ry.Co. and Wilson Line to build a steamer of about 260 feet for the Hamburg and Continental trades for passengers, cargo and fruit. Great attention will be given to the latter, as these steamers come alongside the river quay at all states of the tides. The perishable cargo can be quickly handled and dispatched to the Midlands. The Wilson Liner *Dago*, after overhaul, lengthening, etc., will soon be ready to take her turn in the Russian trade. The new Bull lightship for the Humber Conservancy is now ready in the Dock to be towed to her position at the mouth of the Humber; her lights have been tried, and gave every satisfaction. The works are busy with new orders and repair work, and seem to have plenty of work to keep them busy during the winter months.

Central Dry Dock and Engineering Co., Ltd., are still keeping busy, using their own Dry Dock and the Alexandra Dry Docks, belonging H. & B. Ry. Co. They have in their own dry dock the s.s. *Rescue* and *Thames*, in each case heavy repairs being required, ship bottoms, several plates renewing, etc. The s.s. *Snowdonian*, s.s. *Gottfred*, Swedish steamer, and s.s. *Skarp* have been receiving repairs at heavy cost.

Messrs. T. Tate, Engineers and Boilermarkers.—This firm is plying for repair work around the docks, and is gaining ground every month. The shop is well equipped for general repairs.

Humber Iron Works, Engineers and Shipbuilders, have been fairly busy this month. They have had the following steamers on their patent slip, s.s. *Harold*, s.s. *Helga*, and s.s. *Harald* for extensive repairs on the first two, several new plates in bottoms, and engine and boiler and deck repairs. They have also had several extensive repairs in docks putting steamers through survey.

Messrs. Stewart & Craig, Engineers and Boilermakers, have been kept busy on the following steamers:— s.s. *Metes*, repairs to ship's side plates on bow and stern, also boilers and engine repairs for survey; s.s. *Sigyn*, dry docked; several new plates in bottom and floor plates, deck and engine repairs s.s. *Arlington Court*; and s.s. *Torwald* for general engine and deck work repairs. They have also been busy with the Finland R. M. steamers of Helsingfors. Messrs. Stewart and Craig are keeping to the front as general ship repairers.

Messrs. C. D. Holmes & Co., Engineers and Boilermakers, have built a branch shop, on the Alexandra Dock, which is well equipped for repair work, dry docking, etc. They have not been doing repair work for a number of years now, having confined themselves for some years to building trawlers, but they now intend to cater for repair and new work in all its branches.

Messrs. Cooper & Co., Ltd., Engineers and Boilermakers, are busy in general repairs, also in dry dock work, both at their main shop in Neptune Street and the branch shop at Alexandra Docks.

Messrs. Amos & Smith, Engineers and Boilermakers, are keeping busy with repair work in Town and Alexandra Docks.

North-East Coast Engineering Works.—This new firm have had the *Eros* and *Prudentia* for engine and boiler repairs. They are looking forward for some heavy repair work.

THAMES.

(*From our Own Correspondent.*)

The East End and Shipbuilding.—At the time of going to press we are not in the position to chronicle anything decisive respecting a contract for a man-of-war being placed on this river. It rather seems as if the conditions we have mentioned on previous occasions are against an order being placed again. With the plant ready and labour waiting it will come as a great disappointment to those immeditaely concerned if northern ports secure all the prizes in this way. Knowing the causes that operate against work being placed on the London river does not lessen the necessities of those that are anxiously anticipating such means of utilising their skill, but we may yet hope that points will be strained, so that a complete dispersal of labour in this direction, and which has taken years to collect, may be avoided, to the detriment of shipbuilding and the East End community generally.

Steamship Lines.—It is reported that the P. & O. Co. are likely to be in the market shortly for three of their improved boats of the "M" class, and that the builders are arranged for in Messrs. Caird & Co. and Messrs. Harland & Wolff. If such is the case it proves that this type of vessel has met with favour and that the shipping trade with Australia is in a good condition, which is the route these vessels take. As an experiment we believe the Company are to run their boats of this class on to Tasmania and New Zealand after leaving Australian ports, Auckland being the terminus of the voyage. The *Orvieto*, the fifth 12,000-ton new Orient liner, was due to leave the Thames on the 26th ult. on her maiden voyage to the Commonwealth. The new contract which the Company is inaugurating will really only begin on February 1st next, and there will then be minor changes in the itinerary of the voyages by this Company. The Royal Mail Co. has issued its report and declared an interim dividend of 5 per cent. This Company has recently had launched at Messrs. Harland & Wolff's a new vessel called the *Balantia* for their intercolonial trade. Another Company which has had a boat launched is the Union Castle Line, the vessel being known as the *Grantully Castle*, and to be used as an intermediate steamer. The *Balmoral Castle* has been recently launched at the Fairfield Co.'s works for the same line.

New Lloyd's Chairman.—In succession to the late Mr. James Dixon, Mr. Thos. L. Devitt, the London shipowner, has been appointed Chairman of Lloyd's register. The appointment is reported fully in another column.

Naval Construction Scholarships.—The Shipwrights Co. has decided to give a third Scholarship in Naval Construction, Mr. J. Bruce Ismay, a member of the Guild, having provided the necessary sum to produce £30 a year. Students enter the examination classes from all the large shipbuilding yards of the country.

The Thames and Antarctic Exploration.—With the departure of the *Nimrod* from the river, which while off the Temple Pier was visited by 40,000 people, we have now in the docks for the new expedition of Capt. Scott's the *Terra Nova*, a larger boat. She is 187 feet long and 31½ feet beam, and is of the whaler type, a sailing vessel with auxiliary steam power. The vessel being larger enables a more extensive plant to be taken than the *Nimrod* carried, and therefore there is a chance of greater results following.

New Thames Bridge.—By the decision of the City Corporation it is proposed to build a new bridge to be called St. Paul's Bridge, as it will have its outlet at the northern end of St. Paul's Cathedral. This bridge is proposed to be 80 feet wide and to carry a double line of trams. The cost of this structure is given as £1,640,983. There is also a scheme for the reconstruction of Southwark Bridge before the Corporation, which involves a sum of £261,000. The levels will in this case be altered to facilitate traffic and the bridge widened to 55 feet. Though the general body of London ratepayers are not concerned with the expense to be incurred, as it comes out of the City's pocket, still there is opposition among the City Councilmen, even after the adoption of the Committee's report by the Corporation.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our own Correspondent.)

Messrs. J. I. Thornycroft & Co., Ltd., Woolston.—H.M.S *Savage*: This vessel is now well advanced, and the boilers are shipped, also the water-tight hull work is completed, and work is proceeding on the main and auxiliary piping arrangements. H.M.S.'s *Laine, Lyra, Martin* and *Minstrel*: All the flat and vertical keel plates have been worked, and all frames set for the above destroyers. Shallow draught tug-boat for Russia: This vessel's hull is now plated, and the machinery is well in hand. Mine-laying torpedo base vessel for Portugal: This vessel is well advanced, the plating and the decks were completed last month, also the machinery is now completed. Four ferry steamers for Calcutta: These vessels were dismantled last month and are ready for shipment. 40 feet and 24 feet motor launches: The hulls were completed last month and the motors are now installed. Last month a large amount of repair work was completed, including work for the tug *Johanna*, s.s. *Princess Ena*, yachts *Albion*, *Grianaig* and *Neva*, the transport *Rohilla* and H.M.S.'s *Skylark* and *Bloodhound*.

The Parsons Motor Co., Ltd., Town Quay, Southampton, have lately received orders for two twin-screw sets, each engine being of 60 H.P. One of the orders is from Messrs. Camper & Nicholsons for one right and one left-hand engine for the new 220 ton schooner now building at their yard. The other order is for a twin-screw motor launch for the Metropolitan Police, of the following dimensions:—Length O.A., 52 feet; length B.P., 45 feet. The speed is to be 12 m.p.h., and she will be driven by two 60-H.P. motors with positive reverse gear, etc. In addition to the above the Company are receiving a good number of orders for the smaller type engines embodying the improvements mentioned, so that for the next three months they will be very busy.

Messrs. J. Samuel White & Co., Ltd., East Cowes, I. of W., have recently completed the 33-knot ocean-going torpedo boat destroyer *Crusader*, and the vessel has been handed over to the Naval Authorities. This is the third vessel of the 33-knot ocean-going class which the firm have built and engined. She is fitted with Parsons' turbines and White-Forster boilers, using oil fuel exclusively. The trials of the vessel were most successful in all respects. H.M.S.'s *Harpy* and *Basilisk*, 27-knot ocean-going torpedo-boat destroyers, are also nearing completion. Orders for three further vessels of this class have recently been placed with Messrs. J. S. White & Co., Ltd., for the British Admiralty, named respectively *Redpole*, *Rifleman*, and *Ruby* and work on same is now proceeding. A 52½ feet river launch for Southern Nigeria, named *Wunangi*, has just been completed and shipped, also a motor mail vessel, the *Manatee*, has just completed her trials. She has been built for the Crown Agents for the Colonies and is fitted with two "Kromhout" motors, giving 152 B.H.P. collectively. Both the *Wunangi* and the *Manatee* were constructed to the designs of Messrs. Ridsdale, Wells & Kemp, of 63, Queen Victoria Street, E.C., Naval Architects and Consulting Engineers to the Crown Agents for the Colonies.

Messrs. Summers & Payne, Ltd., Belvidere, Northam, have been busy with the s.y. *Iolanda*—owner, Mr. Morton F. Plant, of New York—including a complete refit and docking, etc. Work was proceeding night and day, and the yacht left with a distinguished party on board on the 17th of last month for an eight months' cruise. She is expected to be at Southampton next June and after about a fortnight's stay will sail for New London (Conn.), Mr. Plant's country seat. *Grianaig*, R.Y.S.: Considerable repairs, etc., are in hand on this yacht, including caulking decks, etc. *Invincible*, R.Y.S., the fine three-masted auxiliary schooner, owner the Hon. Herbert G. Squires, late American Ambassador at Panama, is undergoing extensive alterations and repairs. A new motor launch has been supplied. *Sheelah*, S.Y., owner Mr. James Ross, is having decks recaulked etc., and will go into commission in the early spring. *Javelin* has been stripped, caulked and recoppered and reclassed at Lloyd's and sailed last month. A racing yacht is in course of construction for a Russian owner, and several orders are also in hand for foreign owners and orders for next season's yachting in English waters are also promising.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Admiralty Orders.—Since writing last month several important items of news in connection with Admiralty work have leaked out. There is really no official confirmation of the order of the turbine machinery for the cruiser *Lion*, yet this is an established fact. It is also a fact that an order for a second class cruiser similar to the *Liverpool*, launched at the end of September from Vickers' yard, has been booked. In addition to this there is the order for the "Super-Dreadnought." Nothing has been published about the four vessels to be ordered, tenders for which went in on the fifth of last month, but it can be taken as correct that Barrow have booked an order for a battleship—or to be more correct, will book one shortly, for the orders have not yet been placed. The keels of these vessels will not be put down until about March next year, but in the meantime the preliminary work will be put in hand, so that when the vessel has been started on, work will proceed quickly. There are some in this district who would like to see Vickers' book an order for the cruiser instead, and it is said that inasmuch as they are building the machinery for the sister ship, which will be built at Devonport, they would be in a very favourable position to quote for the other set. It is more likely that the order for the cruiser will be split up into parts—mountings, guns, armour, hull and machinery. At any rate if Vickers' secure the order for the battleship they will do well, and a deal better than some firms. As to where the two floating docks will be built that is a matter which is not settled yet. A paragraph in the "Daily News" credited an order for one to Vickers' in fact it said the work had been commenced upon it; but this is not true, for the firm are at present at work upon the Brazilian floating dock and the Aberdeen dock only.

H.M.S. "Vanguard."—At the end of September the battleship *Vanguard* left Barrow for the Canada Dock, Liverpool, where she was dry-docked, examined and painted. There was a slight hitch in connection with her departure. According to the tide table there was sufficient water to allow of this vessel leaving, but an east wind cut the tide to such an extent that the departure had to be postponed. Fortunately the night tide was better and aided by a bright moon this "Dreadnought" was able to sail and make the Mersey in time to be docked according to schedule. From the Mersey she sailed for Spithead. Since then she has undergone her gun trials and steaming trials. Up to the time of writing everything had passed off satisfactorily. She is due back

at Barrow to complete fitting out on the 28th of November, but this will depend upon the tide. It will be a serious thing for the vessel if there is not sufficient water to allow her to get into the docks again, for then she would have to fit out at some other place, which would mean a great loss to the firm and also to the town generally. In connection with the port of Barrow there is constant trouble about the "Margin," that is the depth of water below the keel of the vessel and above the bar and dock sill. It is constantly causing trouble. On the other hand the dock authorities should know their own business.

The Brazilian Battleships.—Now that the *Vanguard* is away, work is being concentrated upon the Brazilian battleship *Sao Paulo*. The tripod is up and one of the huge funnels is in. There is plenty of time for this vessel to complete, as she is not to be delivered until next July or so. All the boilers and machinery are in the ship and work is proceeding smartly with the guns and mountings. It has come as welcome news that Elswick are about to lay the keel of the third Brazilian battleship the *Rio Jenario*, for Vickers' will construct all the propelling machinery. It is not known yet whether the machinery will be of the reciprocating type or turbine. It was said some time ago that the third vessel would be turbine-driven.

H.M.S. "Liverpool."—The second-class cruiser *Liverpool* was launched at the end of last month from Vickers', and is now fitting out at the old wharf. She is some 450 feet long and 46 feet beam and is to have a speed of 25·6 knots, being driven by Parsons' turbine, made by Vickers'. In connection with this launch it was noticeable that greater precautions were taken by the builders, at the suggestion of the Admiralty no doubt. There was not the same amount of liberty allowed. The launch was private and photographers were restricted to a degree. There will come a time when launches of warships will be strictly private.

Submarines.—The submarines "C 31" and "C 32" left Barrow on Nov. 19th for Portsmouth, accompanied by H.M.S. *Forward*. Evidently the "C" class are satisfactory, for the Admiralty are keeping to this design although there is some more talk of more "D's." Very little has been heard of the "D 1" since she left Barrow a month or two ago, but it is understood that trials and experiments are being made with her.

Hæmatites.—The hæmatite iron trade has shown some signs of weakness, but has never fallen much as regards price, and this is a good sign There seems to be some want of confidence in the market, and orders, although being placed with more frequency, are not for big parcels. The warrant market has not been busy and the settlement price has been about 60/7½ per ton. Makers have been asking 62/- per ton, nett, f.o.b. for mixed Bessemer numbers. The Millom Company have put another furnace into blast and the Distington Company, who had an accident some time ago, have got their plant repaired and are at work again. The steel trade is not very good, and nothing has been done in ship plates as yet. Work has been confined to rails, tin plate bars and billets. Heavy section rails have been selling at about £5 5s. An order for 10,000 tons of rails on Australian account has been missed in this country and has gone to America.

Shipping.—Shipping has only been moderate and freights not high. This year's aggregate of iron and steel shipments is 106,000 tons ahead of last year's for the same period.

BELFAST.

(*From our Own Correspondent.*)

Messrs. Harland & Wolff.—Business at the fitting-out wharves is not by any means brisk, the Queen's Island firm having only one vessel in the water—the Royal Mail Steam Packet Company's new steamer *Balantia*—but there is a considerable amount of tonnage on the stocks, and one or two important contracts are said to have been booked recently. The *Balantia* is a twin-screw vessel 313 feet long, 38 feet 3 inches beam, and about 2,500 tons gross. She has been specially designed and constructed for the Company's intercolonial mail service in the West Indies, accommodation of a superior character being provided for a large number of first and second-class passengers. The vessel has ample capacity for cargo, for the quick handling of which hydraulic cranes have been fitted. A sister-ship, the *Berbice*, was completed and delivered to the owners a few months since, and the *Balantia* will be ready for sea about the middle of December. The new Union-Castle liner *Edinburgh Castle*, which is building at the north end of the yard, will be ready to take the water within a week or two, and the launch of this fine twin-screw vessel will complete Messrs. Harland and Wolff's output of tonnage for 1909. This will fall considerably short of recent years' aggregates, but the end of 1910 should find this firm with a big output to their credit. The entire framing of the White Star Company's *Olympic* has been almost completed; it is expected that this leviathan will be launched towards the latter end of next year. The Holland-Amerika liner *Nieuw Amsterdam*, which was built by Messrs. Harland & Wolff in 1906, has arrived at the Queen's Island for extensive overhaul and alterations.

Messrs. Workman, Clark & Co.—When the returns for the year's shipbuilding come to be published, this firm will be found at the head of the list with a total tonnage of which any firm in the kingdom might be proud. Already they have launched upwards of 70,000 tons, and they have still two or three vessels to put in the water before their list is complete. Since last month's notes were written they have launched three vessels—the *Bahia* and the *Bocaina* for the Lloyd Brazileiro Company, and the *Zacapa*, which is a further addition to the large fleet of steamers which they have built for the Tropical Fruit Steamship Company. The *Zacapa* is 394 feet long, with a gross tonnage of over 5,000, and she is a sister-ship of the *Santa Marta, Metapan, Almirante*, and other vessels constructed for the same owners within the past year or two. The *Bahia* is 354 feet long, and 3,300 tons gross, while the *Bocaina* is 286 feet long, with a gross tonnage of about 1,700. The *Mantiqueira*, a similar vessel to the *Bocaina*, underwent successful speed trials on the 29th of October. The *Rio de Janeiro*, another Lloyd Brazileiro boat also had a thoroughly satisfactory trial trip since last month's notes were published. In addition to the completion of these vessels, Messrs. Workman, Clark and Co. have finished, and handed over to her owners, the magnificent twin-screw Orient liner *Orvieto*. Readers of the "Marine Engineer" are familiar with the particulars of the sisters of this vessel.

"TAURIL" JOINTING MATERIAL.—Reference was made a few months ago to the qualifications of a good jointing material for steam or water joints and the acceptable service rendered by "Tauril" jointing. The good quality of this material has recently found endorsement by the United States Naval authorities, who, after the usual severe tests applied previous to placing a firm of manufacturers on the list, have concluded a contract for the supply of "Tauril" jointing to the various establishments coming under their jurisdiction. This is the second year the contract has been awarded to the U S. agents for "Tauril," and is for a more extended use than formerly, in spite of the duty imposed upon goods not manufactured within American territory. The test of quality and endurance has thus carried more weight than the test of protection. The proprietors of "Tauril" in this country are Messrs Ferguson & Timpson, of London and Glasgow

MESSRS. LEONARD CHAPMAN & CO., Importers and Manufacturers, Munton Road, London, S.E., report:—Graphite, as imported, according to quality:—

Ceylon L.L. c.i.f. London	£24	10	0 to	£46	10	0	per ton.
,, O.L. ,,	16	10	0 to	46	0	0	,,
,, chips ,,	14	10	0 to	34	0	0	,,
,, dust ,,	9	0	0 to	20	10	0	,,
Purified, milled and ground.							
Ceylon, 97% to 99%, f.o.b.							
,, London	59	0	0 to	63	0	0	per ton.
,, 90% to 91%, ,,	40	0	0 to	42	0	0	,,
,, 80% to 81%, ,,	30	0	0 to	32	0	0	,,
,, 70% to 71%, ,,	27	0	0 to	28	0	0	,,
American large flake, f.o.b.							
London	45	0	0 to	49	0	0	,,
,, small ,,	35	0	0 to	45	0	0	,,
Graphite Joint Compd. ,,	2	9	0 to	2	12	6	per cwt.
Graphite Paint Paste ,,	2	2	0 to	2	5	0	,,
Graphite Paint ,,	0	4	9 to	0	5	3	per gal.

Wholesale list of tinned goods on application.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Dalemoor.—On September 30th, Messrs. W. Doxford and Sons, Ltd., successfully launched from their yard at Pallion, Sunderland, a large turret steamer built to the order of Messrs. Walter Runciman & Co., Newcastle. The vessel is 350 ft. in length, 51 ft. in breadth, and of 26½ ft. moulded depth, carrying 7100 tons of deadweight on 22½ ft. draught. The classification is with the Bureau Veritas Registry. Engines, with cylinders 26 in., 42 in. and 68 in. dia. and 45 in. stroke, and two large boilers, are also being supplied by Messrs. Doxford.

Lady Helen.—On October 12th, Messrs. S. P. Austin and Son, Ltd., launched from their shipbuilding and repairing establishment at the Wear Dock Yard, Sunderland, the steel screw steamer *Lady Helen*, to be classed 100 A1 in Lloyd's Register, which has been built to the order of Samuel J. Ditchfield, Esq., of Seaham Harbour. She is designed to carry about 1050 tons deadweight on a light draught, with special facilities for the coal trade. Accommodation for captain and officers is provided in the poop and for engineers in the bridge. The machinery will be supplied by the North-Eastern Marine Engineering Co., Ltd., of good power. The deck machinery includes steam windlass by Clarke, Chapman & Co., Ltd., steam-steering gear by Donkin and Co., steam winches by the Seaham Harbour Engine Works, to be driven from a Blake multitubular donkey boiler.

Minister Delbeke.—On October 13th, there was launched from the Harbour Dockyard of Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, the steel screw steamer *Minister Delbeke*, built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, for Mr. Harry E. Christensen, of Antwerp. The dimensions are as follows:—289 ft. 6 in. by 40 ft. 2 in. by 20 ft. 6½ in., having a single deck with poop, bridge and forecastle and built to the British Corporation Registry's highest class. A double bottom is fitted throughout on the cellular principle and the after peak is arranged as a trimming tank. She is constructed with bulb-angle frames and longitudinal stringers, giving clear holds for the stowage of bulky cargoes, and the bulwarks have been specially strengthened for the carriage of deck cargoes. Four water-tight bulkheads divide the vessel into five water-tight compartments. There are four large cargo hatches with a powerful steam winch to each, and the vessel is replete with the latest improvements for rapid loading and discharging. A powerful quick-warping steam windlass is fitted forward for working the cables, and steam-steering gear is fitted amidships with hand-screw gear aft. Triple-expansion engines will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 20½ in., 33 in., 54 in. by 36 in. stroke, with two large single-ended boilers working at a pressure of 180 lbs. per square inch.

Oakmoor.—On October 14th, Messrs. John Blumer & Co., North Dock, Sunderland, launched the screw steamer *Oakmoor* for Messrs. Walter Runciman & Co., of Newcastle and London. She is of single-deck type with poop, bridge and forecastle, and perfectly clear holds, and is specially adapted for the big timber trade and to carry a large deadweight on a light draught. Water ballast is provided in the double bottom and also in after-peak tank. The accommodation for captain and officers is in the poop, and for the engineers at the after end of bridge. The discharging gear is thoroughly up-to-date in every respect. Engines will be fitted by Messrs. John Dickinson & Sons, Ltd., and the winches and steering gear by Messrs. John Wigham & Son, of Hylton.

Hopper Barge.—On October 21st, the Blyth Shipbuilding and Dry Docks Co., Ltd., launched from their shipbuilding and graving dock works a 600 ton steel dumb hopper barge built to the order of the North Eastern Railway Co., which has been specially constructed in connection with their various docks and harbours. Powerful machinery will be supplied by Messrs. Tangyes, Ltd., of Birmingham, and Messrs. Lobnitz & Co., Ltd., of Renfrew, for raising and lowering hopper doors. This barge is the third of five which the Blyth Shipbuilding and Dry Docks Co., Ltd., are constructing at present for the railway company, and has been built to the specification of T. M. Newell, Esq., chief dock engineer to the N.E.R., and under the general supervision of G. Shaw, Esq.

Queen Maud.—On October 28th, the Northumberland Shipbuilding Co., Ltd., launched from their yard at Howdon-on-Tyne, a finely moulded steamer built to the order of Messrs. Thos. Dunlop & Sons, Glasgow, to augment their fleet of fine steamers. The vessel is the seventh built for this firm, and is 395 long by 49 ft. 9 in. beam by 29 ft. deep and has been built under special survey to the highest class at Lloyd's, with extra strengthening for special freeboard. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation which is very ample being placed in steel houses on the bridge deck. The 'tween decks are lofty and so arranged that cattle-troops, or emigrants may be carried if necessary. The loading and discharging facilities are most complete, the steamer having 10 steam winches by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, and a large number of cargo derricks to ensure the expeditious handling of cargoes. She is fitted with the usual water ballast arrangements for light passages. The machinery will be supplied by Messrs. the North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, consisting of engines with cylinders 24½ in., 40 in., 68 in. by 48 in. stroke, three large steel boilers 14 ft. 6 in. by 11 ft., 180 lbs. pressure. The vessel will carry about 7350 tons deadweight on the light draught of 23 ft. 8 in., and steam about 10 knots loaded at sea. During construction the vessel has been superintended by Mr. Thos. M. Broom on behalf of Messrs. Thos. Dunlop and Sons. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering has been applied to the tank top in boiler-room.

Steam Launch.—On November 16th, Messrs. Edward Finch & Co., Ltd., Bridge Works, Chepstow, launched and on same tide despatched in tow to Bridgwater a steam launch hull 62 ft. long, 14 ft. beam and 6 ft. deep, No. 261 in their books. This craft has been built to the order of the Corporation of Bridgwater, and after being fitted with her propelling machinery and steam turbine pump by Messrs. W. & F. Wills will be used for keeping the bed of the river Parret free from silt.

Gladys.—On November 13th, Messrs. the Goole Shipbuilding and Repairing Co., Ltd., launched from their yard at Goole the s.s. *Gladys*. The vessel is 150 ft. B.P., 25 ft. breadth extreme, and 9 ft. depth moulded. She is constructed to carry about 200 tons of cargo and is ordered by Messrs. the Borneo Co. Ltd. of London, for the Sarawak coasting trade, and is being constructed from the designs and under the supervision of Messrs. Flannery Baggallay and Johnson, of London, Liverpool and Rotterdam, to be highest class at Lloyd's and to be fitted for the towage of lighters. Machinery is to be of compound surface-condensing vertical marine engines with two cranks and is being supplied by Messrs. Richardsons, Westgarth & Co., Ltd. of Middlesbrough, the engines having cylinders with two cranks, the cylinders being 18 in. by 36 in. by 24 in. stroke. Steam is being supplied by a cylindrical multitubular single-ended steel boiler 13 ft. diameter and 10 ft. 6 in. length, to a working pressure of 130 lbs. per square inch. The vessel is up-to-date in all respects for the trade for which she is intended.

Porthgain and Mountcharles.—On November 11th, Messrs. Smith's Dock Co., Ltd. launched from their North Shields yard two steel screw steamers, building to the order of the United Stone Firms, Ltd., of Bristol. The dimensions of the vessels are—135 ft. by 25 ft. by 10 ft. and they will be fitted with compound engines, having cylinders 16 in. and 32 in. by 24 in. stroke. The vessels have been built with a raised quarter-deck, bridge, and topgallant forecastle. The saloon, together with berths for the captain and officers, is arranged under the bridge, and accommodation for the crew is provided under the topgallant forecastle. They are fitted with an exceptionally large hatch for the owners' special trade, with a steam winch at each end for the quick discharge of the cargo. The vessels are built under Lloyd's special survey, and will obtain the highest class [illegible] 100 A1.

Harlingen.—On November 12th, there was launched at Sunderland the steel screw cargo and passenger steamer *Harlingen*, which has been designed and constructed to the order of Messrs. Furness, Withy & Co., Ltd., to augment their service of steamers already running between the ports of Rotterdam and Antwerp and the Bristol Channel. The steamer is 220 ft. in length and has been designed to a very light draught in order to call in at the various shallow draught

ports round the coast, and also to enable her to take cargo for the port of Gloucester without transhipment. The steamer is classed under special survey with the British Corporation, and is a fine model of a first-class passenger and cargo steamer. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Cacique.—On November 15th, Messrs. Short Brothers' Ltd., launched from their shipbuilding establishment, at Pallion, Sunderland, the steamer *Cacique,* built to the order of Messrs. Grace Brothers & Co., Ltd., of New York and London. The principal dimensions of the vessel are:—Length, 410 ft.; breadth, 52 ft. 4 in., and depth moulded, 29 ft. 1½ in., and is designed to carry a deadweight of 8250 tons on a moderate draught of water. The vessel will take Lloyd's highest class, with scantlings considerably increased beyond rules, and is built on the deep bulb-angle frame principle with steel shelter, upper and main decks laid throughout and steel orlop deck fitted in No. 1 hold. The double bottom has been strengthened to carry oil fuel or water ballast and in addition water ballast is provided in fore and after peaks. Sixteen steel derricks are provided on the masts and four derricks on strong posts at cross bunker hatch, in addition to a steel derrick fitted to work from either mast and arranged to lift 30 tons, the masts being specially strengthened to carry this weight. Ten steam winches, steam windlass with quick warping ends, steam-steering gear worked by controlling rods from wheel-house and connected by rods and chains to quadrant tiller, hand-steering gear, patent rudder brake, contraflo winch condenser and steam ash hoist are fitted; all this auxiliary machinery has been specially designed to suit the vessel's trade and is fitted with adjustable brass bushes. The vessel is fitted throughout with electric light, with cargo clusters to each hold and, in addition, Empire acetylene lights are fitted over each hatch. A large multitubular donkey boiler is provided in recess in stokehold. The propelling machinery will be supplied by Messrs. the North-Eastern Marine Engineering Co., Ltd., Wallsend, and consists of quadruple-expansion engines with cylinders 24 in., 34½ in., 49 in. and 71 in. diameter and a stroke of 48 in., taking steam from three multitubular boilers working at 220 lbs. pressure and fitted with Howden's forced draught.

Cloutsham.—On November 16th, Messrs. Wm. Doxford and Sons, Ltd., launched from their yard at Pallion a large single-deck vessel 378 ft. long, 51½ ft. broad and of 30½ ft. moulded depth, built to the order of Messrs. W. J. Tatem and Co., Cardiff. The deadweight carried is about 8000 tons. The classification is with the British Corporation. Messrs. Doxford are also building the engines and boilers for the vessel, which was named the *Cloutsham* by Miss Olga Hedley. Messrs. Wailes, Dove & Co.'s bitumastic enamel was applied to the boiler-room tank, and their bitumastic covering to tank top in boiler-room.

LAUNCHES—Scotch.

Mercurius.—On October 18th, there was launched at Port Glasgow the *Mercurius*, a finely-modelled steel screw steamer of the following dimensions:—Length, 338 ft.; breadth, 44 ft. 3 in.; depth, 21 ft. to main deck. The vessel is for Messrs. Koninklyke, Nederlandsche Stoomboot, Maatschappij, Amsterdam, for their Baltic and Mediterranean trade. She is built on the Isherwood system to Bureau Veritas highest class, and is of the raised quarter-deck type, and has the bow specially strengthened to resist ice. After the launch the vessel was taken in tow to Glasgow, where the machinery will be fitted. This consists of a set of triple-expansion engines, having cylinders 21½ in., 33 in. and 57 in. in diameter, by 39 in. stroke, taking steam from three single-ended boilers 11 ft. 9 in. diameter and 11 ft. 6 in. long, with a working pressure of 180 lb., and fitted with forced draught.

Chiloe.—On October 26th, there was launched at Port Glasgow the passenger and cargo steamer *Chiloe*, which has been built to the order of Messrs. Braun & Blanchard, of Punta Arenas, for their trade between Punta Arenas and Valparaiso. The *Chiloe* is a sister ship to the *Magallanes* recently launched for the same owners, and is of the following dimensions:—Length, 270 ft.; breadth, 37 ft. 5 in.; depth, 21 ft., with a deadweight carrying capacity of 2380 tons. Accommodation has been provided for thirty-two first class, twenty second class, and 200 third class passengers.

Highland Rover.—On October 28th, there was launched at Port Glasgow the steamer *Highland Rover,* of 7200 tons gross, which has been built to the order of Messrs. H. & W. Nelson, Ltd., Liverpool, for their meat-carrying trade between Liverpool and South America. The vessel, which is insulated throughout, is of the following dimensions:—Length, 405 ft.; breadth, 56 ft.; and depth, 29 ft. 6 in. Accommodation is provided for eighty first-class and twenty second-class passengers. The engines will be supplied from Greenock. Messrs. Wailes, Dove & Co.'s bitumastic covering was applied to the tank top in the boiler space, and their bitumastic enamel to the bunkers and boiler-room tank.

Strathlorne.—On October 28th, Messrs. Archd. McMillan and Son, Ltd., Dumbarton, launched the steel screw steamer *Strathlorne,* the second of two vessels they are building to the order of Messrs. Burrell & Son, Glasgow. The vessel is of the following dimensions, *viz.*:—Length, 390 ft.; breadth, 52 ft. 3 in.; depth, 28 ft., and is constructed with clear holds. Large water-ballast capacity is provided for in cellular double bottom, aft peak, and deep tanks amidships. All up-to-date appliances are provided for the rapid handling of cargo, including twelve derricks and ten powerful steam winches. Accommodation is fitted on top of bridge deck for captain, officers and engineers, and the crew are berthed forward. Electric light is installed throughout the vessel The machinery is being supplied by Messrs. John G. Kincaid and Co., Ltd., Greenock, and both vessel and machinery have been built under special survey of the British Corporation for their highest class. During construction the steamer has been built under the supervision of Mr. James C. Stewart, the owners' superintendent, assisted by Mr. W. McA. Morrison, Glasgow.

South Africa.—On November 2nd, the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, launched a steel screw steamer 295 ft. by 42 ft. by 20 ft., for Messrs. Birt, Potter & Hughes, Ltd., London, on behalf of colonial owners, and under the superintendence of Messrs. Wm. Esplen, Son and Swainston, of London. The vessel was named *South Africa*, of Cape Town, and immediately after the launch was placed in the company's dock to receive her machinery, which has also been constructed by the builders.

LAUNCHES—Irish.

Balantia.—On October 28th, the *Balantia*, built for the Royal Mail Steam Packet Co., was launched from the yard of Messrs. Harland & Wolff, Ltd., at Belfast, and is the second of two new intercolonial mail steamers for service in the West Indies. The sister ship, *Berbice,* was delivered to the Company a few months since, and is now on her station. These vessels are 313 ft. long, 38 ft. 3 in. beam, and about 2500 tons gross. The *Balantia* has been provided with passenger accommodation of a superior character for a large number of first and second-saloon passengers, also for deck passengers. The first-class dining-saloon is a spacious apartment situate on the main deck, and extends the whole width of the ship. The sidelights are of large diameter and arranged in pairs, thus ensuring ample ventilation, while the provision of jalousie shutters will provide protection from the sun. The ventilation will be assisted by the provision of large electric fans. The bridge deck will be entirely devoted to first-saloon passengers, the lounge being at the forward end and a verandah at the after end, the latter serving as a semi-enclosed smoking room, cool and comfortable in every way. The second-saloon accommodation on the main deck, with the dining saloon at the after end, will also be of a superior character, and the promenading space for this class, as also for the deck passengers, will likewise be found ample. The *Balantia* will be fitted with electric light throughout, and will also be provided with refrigerating machinery and insulated chambers, and every provision has been made for the safe navigation of the steamer, and by the adoption of two sets of Messrs. Harland & Wolff's balanced quadruple type of engines, vibration is eliminated. The double set of engines for the twin-screws constitutes an additional element of safety. The *Balantia* is constructed on the same principles as the largest modern ocean liners. She will be attractive in appearance, of the shelter-deck type, and provided with hydraulic cranes for the prompt handling of cargo through the large hatches with which she will be provided.

Zacapa.—On October 28th, Messrs. Workman, Clark and Co., Ltd., Belfast, launched from their South Yard another addition to the fleet of steamers built by them to the order of the Tropical Fruit Steamship Co., Ltd., Glasgow. The new vessel, which has been named *Zacapa*, is 394 ft. in length, with a gross tonnage of over 5000, and is intended for the fruit and refrigerated freight trades between West Indian and United States ports. Commodious and comfortable accommodation is provided for a large number of first-class passengers, the state rooms and public rooms alike being handsomely furnished and decorated, and exceptionally well lighted and ventilated throughout. The cargo space is divided into eight compartments, all of which are suitably insulated and otherwise prepared for the carriage of fruit in bulk, the preservation of the cargo being ensured by cooled fresh air delivered into each compartment through ducts from the cooling rooms. The cargo gear consists of steam winches, derricks and all the special appliances required for expeditiously dealing with fruit and general cargo. The propelling machinery consists of a set of improved triple-expansion engines, with all the necessary auxiliary machinery and three large steel multitubular boilers. The *Zacapa* has been built under special survey for the highest class in the British Corporation Registry of Shipping, while the requirements of the British Board of Trade and the United States Steamship Passenger Inspection Service will also be fully complied with.

Lord Stalbridge.—On October 28th, a steel twin-screw tug and passenger steamer, named *Lord Stalbridge*, was launched at Dublin. The vessel, which has been constructed to the order of the Shropshire Union Railways Co. and the London and North-Western Railway for their Manchester Ship Canal and river Mersey service, has been built under Lloyd's special survey, and is of flush deck type, with promenade deck amidships. The machinery is exceptionally powerful for a vessel of this class, consisting, as it does, of two sets of compound surface-condensing engines, having cylinders 14 in. and 30 in. by 20 in. stroke. The boiler is of the single-end return tube description, having a diameter of 11 ft., with an inside length of 10 ft., and constructed for a working pressure of 120 lb. per square inch. The vessel is expected to develop a speed of over 11½ knots.

Bocaina.—On November 1st, Messrs. Workman, Clark and Co. Ltd., Belfast, launched from their North Yard a further addition to the fleet of steamers being built by them to the order of Messrs. Lloyd Brazileiro of Rio de Janeiro. The new steamer, which has been named *Bocaina*, is 280 ft. in length, with a gross tonnage of about 1700, and is a sister vessel to the *Mantiqueira*, which underwent her speed trials on Friday. The *Bocaina* has been built under British Corporation survey for the highest class in their registry of shipping. The vessel will be propelled by twin triple-expansion engines with steam from two steel cylindrical multitubular boilers.

Bahia.—On November 15th, Messrs. Workman Clark and Co., Ltd., launched from their South Yard a handsomely modelled twin-screw steamer built by them for the Lloyd Brazileiro of Rio de Janeiro. The steamer has been named *Bahia*, and is a sister vessel to the T.S.S.'s *Ceara* and *Para*, which recently left the Belfast shipyard. She is 354 ft. in length, with a gross tonnage of over 3300, and has been designed for the Brazilian coasting trade. A special feature of the vessel is the accommodation for first-class passengers in forty-five state rooms on the upper and main decks, all of which are roomy and well appointed apartments and include a number of special *cabines de luxe*. The public rooms include a large dining saloon on the main deck with seating accommodation for over a hundred persons. Accommodation for a number of second-class passengers has been arranged on the main deck forward, the dining saloon being in the centre of the vessel with the state rooms opening off lobbies on each side, and steerage quarters, with iron beds, have been fitted up forward of the second-class accommodation on the main deck. The cargo space is divided into four spacious holds, each of which is furnished with a large hatchway equipped with hydraulic cranes capable of rapidly and efficiently handling a large general cargo. The lower 'tween decks forward have been insulated and fitted up for the carriage of frozen meat cargo, a portion of this space being arranged as cold chambers for the preservation of perishable stores required for use during the voyage. In connection with these insulated spaces there is a complete installation of refrigerating machinery. The propelling machinery consists of two sets of triple-expansion engines with a complete plant of auxiliary engines and three steel cylindrical multitubular boilers working under an improved system of forced draught, also a reserve boiler for supplying steam to the auxiliary and deck machinery. All the machinery has been constructed by Messrs. Workman, Clark & Co., in their Queen's Road Engine and Boiler Works. The vessel has been built under Lloyd's special survey for the highest class in their registry, and complies with the Board of Trade requirements for a foreign-going passenger steamer.

TRIAL TRIPS.

Luabo.—The twin-screw passenger and cargo steamer *Luabo*, built and engined on the Clyde for the Empreza Nacional de Navegacao a Vapor, Lisbon, has been out for her official trials. On two runs between the Cloch and Cumbrae Lights a mean speed of 10¾ knots was attained. The steamer was afterwards tested on the measured mile at Skelmorlie, when a mean speed of 11¼ knots was attained. During the trials the machinery worked without a hitch, and gave satisfaction to all concerned, all the guarantees as to speed having been easily fulfilled. The *Luabo*, which has been constructed to Lloyd's and Board of Trade requirements, has accommodation for twenty first, sixteen second, and fifty third-class passengers. Her propelling machinery consists of two sets of triple-expansion engines supplied with steam at 180 lbs. working pressure from a large steel boiler.

Feliciana.—On October 1st, the fine steel screw steamer *Feliciana*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, left the Tyne for her trial trip. The steamer is 390 ft. long by 49 ft. beam by 29 ft. deep, and has been built under special survey to highest class at Lloyd's, Spar Deck Rule, with extra strengthening for special freeboard. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation which is very ample being placed in steel houses on the bridge deck. The 'tween decks are lofty and so arranged that cattle, troops or emigrants may be carried if necessary. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for, consisting of eight steam winches by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, and steam windlass by Messrs. Emerson, Walker & Thompson Bros. She is fitted, of course, with the usual water-ballast arrangements for light passages. She has been constructed to a fine model with a view to rapid speed and economy, and the machinery has been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in., and 69 in. by 48 in. stroke, three large steel boilers 14 ft. by 10 ft. 9 in., 180 lbs. pressure. The vessel is designed to carry about 7,350 tons deadweight on the light draught of 23 ft. 6 in. The trial trip proved in every way satisfactory.

Star of Canada.—On October 5th, this new steamer left the finishing wharf and steamed down the Belfast Lough for adjustment of compasses, speed trials and trials of auxiliary machinery, all of which proved highly satisfactory. After an enjoyable cruise in the Lough the vessel left for London, and will call on the way at Barry for bunker coal. (See also Launches, September issue).

Leversons.—On October 10th, Messrs. Robert Thompson and Sons, Ltd., launched from their Southwick Yard a finely modelled self trimming collier, built for Messrs. the Gordon Steam Shipping Co., Ltd., of London. The vessel is of the raised quarter and well-deck type, and built to take the highest class at Lloyd's. Her principal dimensions are Length B.P., 268 ft.; breadth 35 ft. 6 in.; depth moulded 19 ft. 8 in.; and will carry about 2000 tons deadweight on a light draught of water, and is fitted with deep bulb-angle framing, the holds being left clear of all obstructions. She has been specially designed for the Hamburg trade, and has four very large hatchways arranged so as to make her perfectly up to date as a self trimmer, and to facilitate rapid

loading. For discharging the cargo there are eight powerful steam winches with latest improvements, placed on raised platforms, and in addition to the usual derricks there are twelve steel gaffs fitted, the masts being amply strengthened for this purpose. To enable her to make quick return voyages ample water ballast is provided for throughout the cellular double bottom and fore and after peaks, the former being divided longitudinally and athwartships for trimming purposes, and fitted with large tank suction pipes and extra large ballast donkey for quickly pumping out water ballast. The mooring arrangements have also received special attention, for in addition to the large fair leads and bitts, steel wire compressors are placed on the poop and forecastle decks. Auxiliary hawse pipes, as well as the usual pipes in bow chocks, are fitted of ample size to take cables when riding in heavy weather. Accommodation for captain and officers is provided in the poop. Spacious rooms for the engineers are arranged at sides of engine casing under bridge deck, the petty officers and crew being berthed in the forecastle. At the forward end of the main bridge the wheelhouse is erected, with lower flying bridge on top, also large teak charthouse, the latter carrying upper flying bridge. The steam winches, also combined steam and hand-steering gear, have been supplied by Messrs. John Lynn & Co., Ltd., and the steam windlass by Messrs. Emerson, Walker & Thompson Bros., Ltd. The engines of the triple-expansion type are by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, having cylinders 21 in., 34 in. and 56 in., with a stroke of 36 in., steam being supplied by two extra large boilers working at 180 lbs. pressure

Salvador.—The *Salvador*, which has just been completed by Messrs. Swan, Hunter & Wigham Richardson, Ltd., at their Neptune Works at Walker, has been out for her trials. Her propelling machinery on the trial trip worked without the slightest hitch, driving the vessel at a speed of 12½ knots per hour. After the trial trip the *Salvador* returned to the Tyne to complete her loading, and she will sail in the course of a few days under the command of Capt. Ellis. (See also Launches).

Breynton.—On October 9th, the handsome steel screw steamer *Breynton*, built by Messrs. Wm. Gray & Co., Ltd., to the order of Messrs. Ralph E. Morel & Co., Cardiff, was taken to sea for her trial trip On the trial a good average speed was maintained, everything working satisfactorily. The vessel afterwards proceeded on her voyage to Barry. (See also Launches).

Westgarth.—On October 16th, the fine steel screw cargo steamer *Westgarth*, built by Sir Raylton Dixon & Co., Ltd., at their Cleveland Dockyards, Middlesbrough, to the order of Messrs. R. & J. H. Rea, of Liverpool, Cardiff and Southampton, proceeded to sea to undergo her official trials. The trials passed off most successfully, and the vessel proceeded to Hull under command of Captain Ralph Johnson to load. The hull and engines have been constructed under the supervision of Mr. H. W. L. Shubrook, the owners' superintendent engineer, assisted by Mr. L. M. Hawson, the owners' resident inspector. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted. (See also Launches).

Bellucia.—On October 16th, the s.s. *Bellucia*, built by Messrs. D. & W. Henderson & Co., Ltd., Partick, Glasgow, for Messrs. Bell Bros. & Co., Glasgow and London, underwent a successful trial trip on the Firth of Clyde. Everything passed off successfully, the vessel easily attaining a mean speed of about 13 knots. After trials, the vessel proceeded to Middlesbrough to load for the River Plate. It is interesting to note that this steamer was completed in the short period of sixteen days from date of launch. (See also Launches).

Winneba.—On October 18th, the s.s. *Winneba* proceeded on her official trial trip off Hartlepool. She has been built to the order of Sir A. L. Jones, K.C.M.G. (Messrs. Elder, Dempster & Co., Liverpool), by Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool. As a result of most exhaustive trials on the Whitley Bay measured mile and between Hartlepool Hough Light and Souter Point, a speed of 13 knots was obtained, the main engines and all auxiliaries working with complete satisfaction. After the trial the vessel proceeded to Middlesbrough to load under the command of Captain Allen. (See also Launches).

Tortona.—On October 18th, the fine twin-screw steamer *Tortona*, built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, to the order of the Cairn Line of Steamships Ltd., Newcastle, of which the managing owners are Messrs. Cairns, Noble & Co., took her trial trip from the Tyne. Her powerful twin-screw engines were built by the Palmer Shipbuilding & Iron Co., of Jarrow, and on the trial developed a speed of 15 knots. After the trial trip the *Tortona* proceeded to Middlesbrough to complete loading for Montreal, from which port she will voyage to Naples to pick up emigrants for Halifax, N.S. Many prominent people were on board for the trial trip. (See also Launches).

Gerania.—On October 20th, the finely-modelled steel screw steamer *Gerania*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of D. Tripcovich, Esq., of Trieste, left the Tyne to undergo her official trial trip. She is the fourth steamer built to the order of D. Tripcovich, Esq., and is a handsome vessel constructed to the highest class at Lloyd's, special survey, and to the requirements of the Austrian Ungarico Veritas. Her dimensions are 402 ft. long by 52 ft. 6 in. beam by 29 ft. 8 in. deep, is designed to carry 8100 tons deadweight, on a moderate draught with space for about 11 500 tons of measurement cargo, and is built on the deep-frame principle, which, while giving great strength to the structure, leaves the holds clear for the stowing and discharging of bulky cargoes. The deck erections consist of poop, long bridge, and topgallant forecastle. A large amount of water ballast is provided in cellular double bottom and fore and after peaks, and in addition a large deep tank is provided so that the vessel will be well immersed when running in ballast. The cellular double bottom is specially constructed for the carrying of oil fuel. Provision is also made for carrying grain cargoes in bulk. The loading and discharging facilities are most complete, the steamer having thirteen steam winches by Messrs. Clarke, Chapman and Co., Ltd., Gateshead-on-Tyne, and a large number of strong derricks on derrick posts and masts with tables and outriggers are arranged, also two 20-ton steel derricks stepped on deck for the expeditions handling of cargoes, powerful steam steering gear by Messrs. Donkin & Co., steam windlass, etc., and capstan by Messrs. Emerson, Walker & Thompson Bros. The 'tween decks are spacious and very lofty and suitable for either troops, emigrants or cattle. A complete installation of electric light for efficiently lighting the vessel throughout is provided by Messrs. Clarke, Chapman & Co., Ltd. Powerful machinery has been supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend, with cylinders 26 in., 42 in. and 72 in. by 48 in. stroke, three large boilers working at 180 lbs. pressure. The loaded trial trip proved in every way highly satisfactory, and a speed of over 11 knots was easily maintained. After the trial trip the s.s. *Gerania* sailed under the command of Captain Vesut for Trieste with a full cargo of about 8000 tons of coal, including bunkers.

Togston.—On October 21st, the self-trimming collier *Togston*, specially built by Messrs. Osbourne, Graham & Co., of Hylton, to the order of Messrs. The Broomhill Collieries, Ltd., Newcastle-on-Tyne, through Messrs. Furness, Withy and Co., Ltd., made her official trial trip. Her engines are by Messrs. Richardson, Westgarth & Co., Ltd., of Sunderland. A Cochran (Annan) donkey boiler with patent seamless furnace has been fitted. There was a large company present, and the trial proved in every way satisfactory, a speed of 10½ knots being easily attained. (See also Launches, November, 1909.)

Germaine.—On October 22nd, the new steamer *Germaine*, built by the Sunderland Shipbuilding Company, Ltd., proceeded on her official loaded trial. After proceeding to sea, the vessel made several runs over the measured mile fully loaded, when a mean speed of 10½ knots per hour was obtained. After this a continuous speed trial was run, which gave entire satisfaction to all on board. The necessary revolutions were easily attained without stoppage of any kind. After the trial, the vessel proceeded on her voyage to Caen. (See also Launches, November, 1909.)

Ashtree.—On October 23rd, the steel screw steamer *Ashtree*, built by Messrs. Craig, Taylor & Co., Limited, Stockton-on-Tees, to the order of Messrs. Howard-Jones & King, Cardiff, was taken to sea for her trial trip, which proved highly

satisfactory. During the whole of the trip everything worked with the greatest smoothness, and over a series of runs between Hartlepool Heugh and Redcar Buoy, a speed of 11¾ knots was maintained. All those who were on board the vessel expressed themselves as being highly pleased with the ship and engines. After the trial trip the vessel proceeded to Jarrow, under command of Captain Thomas. (See also Launches, November, 1909.)

Rio de Janeiro.—On October 27th, this handsome steamer, built by Messrs. Workman, Clark & Co., Ltd., of Belfast, to the order of the Lloyd Brazileiro of Rio de Janeiro, left the Alexandra Wharf and steamed down the Lough for adjustment of compasses, speed and auxiliary machinery trials. The results of the various trials were of the most satisfactory character, the speed attained being considerably in excess of the guaranteed speed, while the behaviour of the vessel under all conditions gave the utmost satisfaction. The new steamer is 366 feet in length, with a gross tonnage of over 3,500 tons, and is intended for passenger and cargo trade between New York and the principal ports on the South American Coast. Accommodation is provided for over fifty first-class, twenty second-class, and one hundred and fifty third-class passengers, and all the public and private rooms throughout the vessel have been designed and fitted up with a view to ensuring the utmost comfort and pleasure of their occupiers. The cargo space has been divided into four spacious holds, and one of the 'tween deck spaces has been insulated and otherwise specially prepared for the carriage of perishable cargo, while insulated chambers are also provided for the stowage of provisions required during the voyage. For the preservation of the perishable cargo and stores an efficient system of refrigerating machinery has been installed. Each of the cargo holds is fully equipped with a couple of powerful steam cranes and other appliances necessary for handling general cargo. The propelling machinery consists of two sets of triple-expansion engines with a complete installation of auxiliary appliances, steam being supplied by three steel cylindrical boilers working under an improved system of forced draught. The vessel has been built under Lloyd's special survey for the highest class in their Register and complies with the Board of Trade requirements for a foreign-going passenger and cargo steamer.

Mantiqueira.—On Oct. 29th, the new twin-screw steamer *Mantiqueira*, built by Messrs. Workman, Clark & Co., Ltd. Belfast, for the Lloyd Brazileiro of Rio de Janeiro, left the builder's wharf and steamed down the Lough to have her compasses adjusted, after which she underwent her speed and machinery trials, all of which gave the utmost satisfaction. The *Mantiqueira* is 286 feet in length, with a gross tonnage of about 1,700, and has been designed to the owners' requirements for their Brazilian Coasting trade, having been built under special survey for classification in the British Corporation Registry of Shipping. The cargo space is divided into two commodious holds, having the minimum of obstruction, the vessel being constructed on the fore-and-aft girder principle. Each of the holds is provided with two extra large hatchways equipped with a pair of powerful steam winches and the necessary derricks and appliances necessary for handling general cargo. The propelling machinery consists of two sets of triple-expansion engines with the necessary auxiliaries and two steel cylindrical multitubular boilers.

Treveal.—On November 4th, the new screw steamer *Treveal*, built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of Messrs. Edward Hain and Sons, St. Ives, Cornwall, was taken to sea on her official trial trip. The vessel was run several times over the measured mile, her machinery working very smoothly and the trial giving every satisfaction to all concerned. She afterwards proceeded to Tyne Dock to load for Leghorn under the command of Captain John Hain. (See also Launches November, 1909.)

Parisiana—On November 4th, the finely-modelled steamer *Parisiana*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. Furness, Withy & Co., Ltd., of London and West Hartlepool, left the Tyne to undergo her official trial trip. The trial trip proved in every way satisfactory and a speed of 12½ knots was easily obtained. Many prominent persons were on board for the trial. Messrs. Wailes, Dove & Co.'s bitumastic enamel has been applied to the boiler-room tank and tank top. (See also Launches, November, 1909).

Natalia—On November 6th, the *Natalia*, which has been built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., at their Neptune Works, Newcastle-on-Tyne, to the order of the Linea de Vapores Serra, of Bilbao (Spain), underwent a very successful trial trip. On the trial trip the vessel attained a speed of 12 knots per hour, and immediately on the conclusion sailed under the command of Captain Cirarda. (See also Launches, November, 1909).

Argus.—On November 11th, the twin-screw steamer *Argus*, recently launched by Messrs. Ramage & Ferguson, Ltd., Leith, for the Corporation of Trinity House, London, completed on the Firth of Forth exhaustive trials of three days' duration. The trials were entirely satisfactory, the speed attained being considerably in excess of the guaranteed speed; the requirements as to carrying capacity, draughts, trim, stability, etc., have also been fulfilled. The Corporation of Trinity House was represented at the trials by Captain Blake, the chairman, and Captain Flint, Sir Thos. Matthews and Mr. Renton, engineers to the Corporation, and Mr. Frank C. Goodall, surveyor of shipping; Mr. Dick Peddie, secretary to the Northern Lighthouse Commissioners, was among the guests. The *Argus* sails early next month for Blackwall. Messrs. Wailes, Dove & Co.'s bitumastic enamel has been applied to engine and boiler-room tanks and bunkers, and their bitumastic covering to the tank top in boiler-room. (See also Launches, October, 1909.)

Bassam.—On November 13th, the steel screw steamer *Bassam* proceeded from Hartlepool Harbour to undergo her official trial trip in Hartlepool Bay. The vessel has been built by Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, for Sir Alfred Jones, K.C.M.G. (Messrs. Elder Dempster & Co., Liverpool). The dimensions are:—Length 355 ft., beam extreme, 46 ft. by 25 ft. 3 in. depth moulded to upper deck. She is classed 100 A1 at Lloyd's andh as cellular double bottom all fore and aft with after peak tank for water ballast. The vessel is divided into seven water-tight compartments by means of six transverse bulkheads. Every attention has been paid to all appliances for the rapid loading and discharging of cargo, the ship having ten powerful steam winches of the builders' own design and ten derricks capable of lifting five tons each. Provision is made on each mast for a special derrick capable of lifting 15 ton loads, whilst the whole of the mast arrangement is strengthened to lift 40 tons. Accommodation for a limited number of passengers is provided on the shelter deck and bridge deck, together with accommodation for the captain and officers in a steel house on the shelter deck amidships and for the engineers in a steel house abreast the casing. By the thoughtfulness of Sir Alfred Jones, a library containing a judicious selection of well-known novels is furnished for the use of the crew, and will no doubt be heartily appreciated. To provide efficient ventilation, very large patent upcast and downcast ventilators are being fitted, together with six surf-boats of special design for carrying palm oil, etc., through the surf, Messrs. Elder, Dempster & Co. doing a very large business in this line. A complete installation of electric light is fitted including signal lamps, binnacles and cargo clusters at each hatch, as well as oil lamps for emergency purposes. Steam-steering gear is placed amidships, which leads aft to quadrant led alongside hatches. There is a quick-warping steam windlass forward and a large multitubular donkey boiler of ample capacity for the supply of steam to the deck and auxiliary machinery. The engines, which worked splendidly throughout the trials, have been supplied by Messrs. Richardsons, Westgarth & Co., Ltd. Hartlepool, the sizes of the cylinders being 25 in., 40 in., 67 in. by 45 in. stroke, with two boilers 10 ft. 6 in. by 10 ft. 9 in., 180 lbs. pressure. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel has been applied to the boiler-room tank, and their "Bitumastic" covering to the tank top in boiler-room. The trial was in every way satisfactory on the run between the lights, but the weather was too bad to run the vessel on the measured mile.

Netherpark.—On November 13th, the fine steel screw steamer *Netherpark*, built by the Northumberland Shipbuilding Co., Ltd., Howdon on Tyne, to the order of Messrs.

John Greenlees & Co., of Glasgow, left the Tyne to undergo her official trial trip. The trial trip proved in every way satisfactory. After the trial trip the vessel proceeded to Cardiff to load under the command of Captain Taylor. Messrs. Wailes, Dove & Co.'s bitumastic covering has been applied to the tank top in boiler-room and their bitumastic enamel to the tank margin plating. (See also Launches, November, 1909).

Guanabacoa.—On the 6th October, a successful trial took place on the Mersey of the double-ended steel screw ferry steamer *Guanabacoa*, designed and supervised by Messrs. James Pollock, Sons & Co., Ltd., of 3, Lloyd's Avenue, London, E.C., and built and engined by Messrs. Cammell, Laird and Co., Ltd., of Birkenhead, whilst the boilers were supplied by Messrs. Babcock & Wilcox, Glasgow. The *Guanabacoa* is 140 ft. by 55 ft. overall with a moulded depth of 14 ft. 5 in., and is classed 100 A1 at Lloyd's. She has a propeller surrounded by a Pollock patent stern frame, rudders, steering wheels and pilot houses at each end. The main deck is carried out on each side to form sponsons on which rest fore and aft cabins with seating accommodation for 300 passengers. The engines, which are of the inverted compound surface-condensing marine type, have cylinders 19⅛ in. and 42 in. by 27 in. stroke, indicating 940 horse power, running at 148 revolutions per minute. The engines were arranged to drive a propeller at each end through one line of shafting running the entire length of the vessel. The handling gear for the main engines is arranged on a wrought-steel quadrant in the engine house on the main deck. The *Guanabacoa* is fitted with a complete electric light arrangement, the cabin illumination being especially lavish, the fittings all being in plume bronze. The wiring is carried out on the two-wire system. Cartways for the accommodation of vehicular traffic run between the saloons and the engine casings. Steel curbs are formed in way of casings and saloon side plating on deck level so as to prevent the carts rubbing the sides of the houses.

SHIPBUILDING RETURNS FOR 1909.—We shall publish in our January issue The Shipbuilding Returns of the World, giving details of the vessels launched during 1909. This has been the feature of our January number for many years past. The number is a double one, but is the same price. It has a big circulation, and is specially kept for reference.

INSTITUTE OF MARINE ENGINEERS. PRESENTATION OF THE DENNY GOLD MEDAL.—At the Institute of Marine Engineers on Monday evening, November 15th, the Denny Gold Medal was presented to Mr. Wm. P. Durtnall for his paper on "The Generation and Electrical Transmission of Power for Main Marine Propulsion and Speed Regulation," read in July, 1908. In making the presentation, Mr. J. T. Milton (Chairman of Council), said the paper Mr. Durtnall had given was a very valuable one and several useful discussions had taken place upon it. It was a subject which was giving a great deal of thought to engineers, and the Council of the Institute considered the paper to be the best submitted during the session and well worthy of the award. Mr. Durtnall, in acknowledging the presentation, said he valued the Medal very highly indeed, all the more as he was a member of the electrical profession, which profession would, in his opinion, become more closely allied to marine engineering in the near future. He had pleasure in informing the members that the subject was being taken up in a practical form. A cargo boat would be fitted with this system of propulsion in about seven months' time, and he would be pleased to present the results of the trials of that vessel to the Institute as soon as they could be ascertained.

BOARD OF TRADE EXAMINATIONS.

1909 Extra First Class

Oct 30th—Clements, A B	..	Ex 1C Glasgow
,, 30th—Fordyce, T	..	Ex 1C Glasgow
,, 30th—Hogan, W S	..	Ex 1C Belfast
,, 30th—Holt, S	..	Ex 1C Liverpool
Nov 5th—Johnson, R W		Ex 1C N.Shields
Oct 30th—Larter, W. H		Ex 1C London
,, 30th—Sowter, A K		Ex 1C London
,, 37th—Walkinshaw, W		Ex 1C Barrow
,, 30th—Woodford, F J.		Ex 1C London

NOTE—1C denotes First Class 2C Second Class.

October 30th, 1909.

Bates, W L. .. 1C Hull
Black, W .... 1C Aberdeen
Brook, A. C. .. 2C Greenock
Caws, W. G .. 2C London
Dewar, W. .. 1C Aberdeen
Downie, T. S. 1C Sunderl'd
Duncan, W F. R 2C Aberdeen
Dunlop, A .... 2C Greenock
Ferguson, P .. 1C Greenock
Gallagher, J. .. 2C Liverpool
Green, F. L .. 1C London
Hall, E. S .... 2C London
Hall, E. W .. 1C Liverpool
Harris, E .... 2C London
Hay, J......... 1C Greenock
Herriot, W .... 1C Liverpool
Hutchinson, D J 2C Liverpool
Lambert, J W 1C N Shields
Lane, J .. .. 2C N.Shields
Luke, R W .. 1C Bristol
Macleod, W A 1C Greenock
Mitchell, .. 1C Aberdeen
More, G A .. 1C Sunderl'd
Morton, W .. 1C Aberdeen
Nickson, E N 1C Liverpool
Pattinson, H W 1C Liverpool
Pinkney, F T 2C Sunderl'd
Renton, A N .. 1C Sunderl'd
Rischmiller, H 1C N Shields
Rossolimos, J 2C Sunderl'd
Ruthven, J C. 2C Greenock
Satterley, R G 2C Bristol
Smith, H W... 2C London
Stewart, J. .... 1C Aberdeen
Tapper, G V 1C N.Shields
Watson, R G 1C Aberdeen
Williams, A W 1C Aberdeen
Wilson, W. D 2C Aberdeen
Young, H L... 1C Greenock

November 5th

Boyce, I D .. 2C South'ton
Bremner, J B. 1C South'ton
Chisholm, R .. 1C Leith
Daugherty, J E 2C Liverpool
Davey, F .... 1C Liverpool
Derricks, A .. 2C N Shields
Duncan, R .... 2C N Shields
Edwards, F .. 2C Leith
Elder, J A .... 2C Glasgow
Elliott, W N 2C Belfast
Ferguson, K M. 2C Cardiff
Geary, J ...... 1C Belfast
Gibbs, S. J .... 1C Cardiff
Hain, J ...... 2C Falmouth
Heatley, G .... 2C N Shields
Hunter, J ... 1C London
Holland, G T 1C Cardiff
James, J. ...... 1C Cardiff
Kemp, H. H .. 2C Cardiff
Laidlaw, J W 2C Leith
M'Kelvie, T R. 1C Liverpool
M'Lachlan, F. J 2C Glasgow
Mee, P .. .. 2C Cardiff
Mitchell, W F 2C Cardiff
Moloney, J E 2C Cardiff
Muir, A. J .... 1C Glasgow
Osborne, J Q 1C Belfast
Poole, A. H .. 1C N.Shields
Ritchie, R. D 2C Liverpool
Rogers, T .... 2C Falmouth
Sanders, G. H. 1C Cardiff
Sims, G P. W 2C N.Shields
Smith, R .... 1C N.Shields
Swan, A W .. 1C Glasgow
Webb, G W... 2C Liverpool
White, H .... 1C Liverpool
Whitehouse, R 2C Liverpool
Wilson, W W. 2C N.Shields

November 12th.

Batchen, G .. 2C Greenock
Bilsland, R .. 2C London
Blair, W....... 1C Dundee
Blair, W....... 2C Greenock
Branson, H A. 2C London
Buchanan, W.P. 1C Greenock
Campbell, D. S. 2C Greenock
Dean, D. ...... 2C Greenock
English, T. .... 2C Greenock
Forrester, G. .. 2C Liverpool
Hemphill, H .. 2C Dublin
Irvine, W. .... 2C Dublin
Jenkins, H .... 2C N.Shields
Jones, J. G..... 1C London
Jones, O. P. .. 2C Dublin
Lonsdale, H .. 1C N.Shields
Nelson, J. .... 1C Dundee
Owen, J. L .. 2C London
Paton, A. .... 1C Greenock
Pollock, J. .... 1C Dublin
Rankin, G. P. 1C Dundee
Redford, J. W. 1C Hull
Richards, R. S. 2C Liverpool
Richardson, P 2C Liverpool
Roach, C. G .. 1C London
Rowe, W G. .. 2C Liverpool
Scott, J. F .... 2C Hull
Smith, H. F. .. 2C London
Starkey, F. J .. 1C Hull
Telfer, P A .. 2C Greenock
Tucker, H W 1C London

November 19th.

Atkinson, R. .. 2C N.Shields
Birnie, G. A. .. 2C Cardiff
Blair, T. A..... 1C Liverpool
Brough, E. .... 2C N.Shields
Brown, J .... 2C Leith
Campbell, R .. 2C South'ton
Cay, M. ...... 2C South'ton
Charnock, J. .. 2C Liverpool
Churchill, J. P. 1C Cardiff
Cochrane, R. S. 1C Leith
Cunningham, H. 1C Glasgow
Dickson, A..... 1C Glasgow
Dixon, E....... 1C Barrow
Dixon, H. M... 1C London
Dunning, G C 2C N.Shields
Fearon, F. H 2C Glasgow
Fowler, A .... 2C W. Hart'l
Fox, J. F. .... 1C Cardiff
Grant, J. S..... 2C Leith
Greenberg, F. 2C N.Shields
Halliburton, W. 1C Cardiff
Hedley, W. J... 2C N Shields
Hogg, J. A .... 2C Cardiff
Hope, F. R..... 2C W Hart'l
Howatson, J.W 1C N Shields
Hunter, F. D .. 2C London
Hutchison, R B. 2C Glasgow
Jarman, J. A .. 2C Liverpool
Johns, D ...... 2C Liverpool
Johnson, M W 2C W Hart'l
Kelly, J. C..... 1C Glasgow
Lang, W....... 2C Glasgow
Lee, G. S .... 2C Liverpool
Lowe, D .... 1C W. Hart'l
MacCullum, R 2C Glasgow
McDiarmid, R. 2C Glasgow
Moore, W. L .. 2C Liverpool
Nicholls, J. .... 1C Cardiff
Nicholson, N M. 2C Leith
Paddison, S. H 1C Cardiff
Parkin, L. .... 1C London
Parry, J. H. .. 2C Barrow
Penney, W. E. 2C South'ton
Ranson, G. S. 2C N Shields
Smith, F....... 1C Barrow
Swede, T M. .. 1C London
Tennent, W. W. 1C Glasgow
Todd, W L. .. 2C Glasgow
Tulloch, G..... 2C Glasgow
Watson, R. M. 1C N.Shields
Watts, J. C..... 2C Leith
White S J .. 1C N Shields

The Marine Engineer

And Naval Architect.

LONDON, JANUARY, 1910.

A REVIEW of the past year embraces within its area many cultivated fields of trade and commerce, with well-beaten tracks and landmarks, and a few pastures new where the infrequent pathway reveals but the light tread of the hopeful experimenter. The inventor has not been idle, but fewer cases have come under our observation where the would-be patentee, buoyed up by the hope that wealth and fame would follow swiftly on to meet his beck and call, pursued a chimera, and finding that when his fondly cherished ideas were put into tangible shape to meet the ruthless criticism of experience, the laws of nature were against him. Probably the extension of technical education and the improvements in connection with patent law have combined to clear many problems. On the other hand there are many inventors and experimentalists who have been brought within reach of success, if not of opulence, by dint of many trials born of caution and close persistent effort. New methods, better systems and improved facilities for building and manufacturing make towards reducing cost of production, and are welcome elements in the national economy. They tell also in competing in the market with others now well situated and able to accept specifications from near and far. The cost of production is only one aspect of the question, and evidences have not been wanting to show that along side of it another aspect has not been lost sight of—the cost of running. Advantage has been taken of the comparative slackness to effect improvements with a view to reduced costs, and our pages have revealed the efforts being made to reduce the percentage of losses and running costs. The experimental venture, which has not met with success in the Mediterranean, threw two very fine steamers back on the market, and it may be that the alterations being made in connection with them will result in a more prosperous sequel to their history. The old-established companies have for the most part been adding new steamers to their fleets and disposing of their older and obsolete vessels. The losses of the year have been heavy, several of these being of a nature which cast much gloom over many households. The monetary losses borne by the underwriters have also proved severe. Towards the last half of the year an improvement has been manifest, and the number of vessels placed on order lately is refreshing to note. The actions of most of our contemporary rivals have been in the direction of excluding more and more rigidly from their own flag and waters, ships and material produced elsewhere, with a view to adding a bolster to raise the head of an industry, unable or unwilling to sit up without such adventitious aid; no doubt these actions have militated to some extent against the shipbuilding and manufacturing trades of this country, but in spite of the restrictions in many cases these have been surmounted and have but served as spurs to improvements in organization and machinery. The trade between this country and the continents of Europe and America in iron and steel is considerable, and the importation of forgings and plates has excited many controversies which are not for our pages: the fact of the delivery of continental forgings and plates to meet our own requirements is one which concerns the captains of our own iron and steel industries to meet and overcome for their own advantage, and what is to their advantage in this respect is to the advantage of the nation, if it stimulates the inventive mind to improved methods to meet the opposing forces in the market place. Questions affecting the coal industry have been much in evidence. The re-imposition of the tax with a view to conserve our supplies for our own services has been considered in many quarters as desirable, and has produced much quiet discussion. A tax would add to the cost at coaling stations, and thus affect our own carrying trade; on this and other grounds, from the colliery and collier points of view, the tax appears objectionable. The difficulties in the way of making modifications in the former act to meet the obvious objections are great, but possibly not insuperable. It has been matter of surprise, in view of the smoke and the smuts which render our city atmosphere so objectionable, that the use of anthracite for heating purposes has not come into more general use than we have found it. The price is to some extent a deterrent, but the advantages are great, and we export a considerable quantity.

The new acts in respect to colliery working appear to be coming into operation, fortunately without strife and by mutual concessions for mutual advantage. The unfortunate strike in Australasia has been the means of unhinging the reins of business, causing inconvenience and loss, not only to those more immediately concerned in the coal industry and in other industries dependent upon carriage of goods, but to the whole Commonwealth. It is now happily ended so far as can be judged, and it is hoped ended on a permanent basis to avoid disastrous dislocations of trade.

The past year has been notable for the deaths of the heads of many shipping companies, and of others well known in shipping and engineering communities, men who have inaugurated lines, or who have maintained continuity of policy and upheld the dignity of the national trade and commerce. The successes which have attended the producer gas engine for land purposes, and the trials of oil engines, which have been so far successful for small vessels on sea, added to the more extended use of electric current for both land and sea purposes, are bringing nearer the possibilities of electrical transmission for marine propulsion. The non-reversibility of the producer

gas engine, and of the oil engine, appears to be nearer solution, if not already solved. The magnetic drive question has advanced a stage, and we note that a paper on the subject is announced to be read early in March. Should this system be suitable for large installations, as it has been proved to be on trial for small, it would prove a successful solution of the revolution question between the motor and propeller.

The prosperity which has attended Canada is a feature of the year which comes before us in several ways. The fine steamers which have been built for the lake services, and the increasing size and the excellence of the vessels which cross from our Home ports to those of the Dominion are healthy evidences, while the negotiations rumoured to be in progress for further extensions and developments to link up the Dominion show that enterprise is not lacking. The mining industry appears to be growing apace, and recent reports indicate that very favourable results are being obtained from the production of minerals.

The progress of the ship of the air has been marked since this time a year ago, and while several successes have been scored there have been many failures, but it is evidence of what the future may possibly hold when we note that already there are stationed on continental frontiers aerial warships, while there are now established factories for the construction of airships both for peaceful and warlike service. The building of torpedo vessels on the Northern Rivers has been attended with success, and one more firm has been added to the list of builders. The war vessels for ourselves which have been recently placed have tended to give heart to a few builders, and the probable requirements of South America have increased the hopefulness of others, while the visit of the Chinese Prince and suite to various centres has raised the desires of not a few that one of the results of the visit may be specifications for vessels wanted. The Exhibitions which have been announced for 1910 at Shepherd's Bush, from May to October, Olympia in September, and Manchester from October to November, bid fair to offer many attractions to engineers, as well as to the general public.

THE WORKING OF PARSONS' STEAM TURBINES ON FAST CHANNEL STEAMERS.

MUCH of the matter which has been written on turbines up to the present has been by those engaged in their construction, and consequently their point of view may be regarded as somewhat different from that of the Engineer who is responsible on board ship for their efficient working. One recognises that the builder has facilities for obtaining information up to the time of handing the vessel over to the owners, but such information must necessarily be very limited in character, and it is to the man who has to live with the turbine from day to day that one must go for reliable information as to general performance. A very interesting paper has been read by Mr. C. J. Blackburn before the Liverpool Engineering Society on the working of Parsons' steam turbines on fast channel steamers. It is pointed out by the author that although six years ago the adoption of turbines for fast channel steamers was regarded with considerable suspicion, the success of this means of propulsion has been almost phenomenal, and it is beginning to be recognised that those companies which have not introduced the system are in danger of being regarded as behind the times. The total number of mercantile steamers running with Parsons' turbines at the present time is sixty-nine, with a total horse-power of 606,000, and of these, twenty-three are channel steamers with a total horse-power of 193,000. The total number of war vessels built and under construction is 194, with a total horse-power of 2,700,000, while the total number of all vessels built and under construction at the present time with this turbine is about 275, having a total horse-power of about $3\frac{1}{4}$ millions. It is interesting to note that the turbine steamer is the safest one by which a passenger can travel judging from the records to date, and it is reasonable to assume that the machine being free from sudden shocks is in itself a very strong guarantee against accident. The failure of a shaft of a turbine steamer is, and probably will continne to be, a thing unknown, as its steady working in all weathers would seem to be a guarantee against breakage. It would appear that from the author's experience the greatest danger to the safety of a vessel of this class arises from faulty auxiliary machinery, which is generally of the reciprocating order; the only breakdown recorded being that of the fracture of the crank on a circulating engine, the accident happened, moreover, when the steamer was nearing port, and the break was of such a nature that it was possible to keep the engine going, otherwise considerable difficulty would have been experienced in making the landing-place. The manœuvring power of turbine steamers becomes a very important question where short runs are made between stopping-places, and it is quite possible that experience will show the necessity for increasing the power of the astern turbine, in order that an undesirable length of time of getting alongside and away again from the landing-place, shall be avoided. A point of importance mentioned by the author in this connection, is that the increased steering power, due to the stream of water projected on to the rudder from the middle propeller, constitutes an important feature contributing to the safety of the turbine channel steamer when sailing in narrow and crowded waters. Particulars are given in the paper showing the wonderful reliability of the turbine for regularity of speed over a considerable number of runs during last season, and this is borne out by the wonderfully

regular work done by the Atlantic liners *Lusitania* and *Mauretania* in all weathers, it having been reported that the latter vessel in eleven consecutive voyages averaged 25½ knots per hour. Experience has shown that the handling of a turbine engine can be much more rapidly done than with a reciprocating engine, and little or no danger can arise as long as the operations are carried out intelligently.

With reference to boilers, experience has shown that zinc plates seem to disappear more rapidly than is the case with a reciprocating engine, and a judicial use of zinc powder with the feed water and the introduction of a little sea water and common soda, have beneficial results. As a high vacuum is one of the essential points in connection with the economical working of the turbine, the necessity for having a thoroughly satisfactory design of condenser becomes very prominent, otherwise not only does the efficiency of the turbine drop, but the very life of the turbine itself may be materially reduced owing to the impurities carried into the engine and blocking the small openings between the blades, roughening the smooth surfaces, and setting up corrosion of the dummy rings in the interior of the rotors and the casings. The question of vibration in turbine steamers has caused some anxiety from time to time, and the author is convinced that the middle propeller is responsible for most of the vibration in the three-propeller turbine steamer, and suggests that the substitution of a four for a three-bladed propeller on the middle shaft would have a good effect. The cost of running turbines on channel steamers developing their full power will be found to compare favourably with that of vessels fitted with reciprocating engines. The coal bill may be slightly increased, but the saving in the combined cost of wages, oil, packing, etc., will amount to fully 15%, and this, with the reduced cost of upkeep, will in a few years put the turbines in a very favourable position in this respect.

On the whole, we think that Mr. Blackburn has been able to give interesting particulars of a satisfactory nature with regard to the working of turbines, and the experience of those who have had to deal with the results of not so satisfactory a character will materially add to the interest of a paper which we are sure has been received with gratitude and appreciation by those who are interested in the subject.

MARINE PROPULSION BY ELECTRIC MOTORS

Considerable attention has been given of late to the question of the economical adaptation of electricity as the transmitting power medium to suit the altered conditions of the steam turbine and the internal combustion engine as prime movers in relation to the propeller as compared with those which obtain in using a reciprocating steam engine. The subject has been treated in a comprehensive manner in a paper read by Mr. H. A. Mavor at a recent meeting of the Institution of Civil Engineers. It is pointed out in this paper that a comparative study of the methods of applying power on land to the propulsion of vehicles and other purposes, and of the methods adopted at sea, shows that, while the problems have much in common there are differences in methods and in experimental results which have mutually inter-acted from time to time between sea and land practice, tending towards assimilation with a gradual improvement in the economic results in both cases. After dealing with the general functions and scope of the steam turbine and internal combustion engine the proposition set out by the author is to provide an electrical equipment intermediate between the prime mover and the propeller, extending the limits of practical economy in each by modifying the restrictions which the prime mover and propeller impose upon one another, and making such provision that the prime movers may operate at or near the constant speed necessary for maximum efficiency and full power, and that the power expended in driving machinery not required for work is reduced to a minimum, if not entirely eliminated. At full power all the generating plant should be in operation to full capacity, and concentrated in driving the ship, while for conditions of less power the generating plant can be shut down in sections. In order to accomplish these ends, the author proposes to use special motors, which will give the necessary changes of speed and direction, and permit of the advantageous combination or elimination of the power generators. Alternating current is alone available for the purpose in question, and normal motors have, therefore, a fixed speed of rotation, which is a simple multiple of the generator speed. The motor system proposed for use is the "Spinner," which allows an ordinary motor to drive the propeller at a fixed speed with the shaft and propeller directly coupled, and arranged to be rotatable as a whole about the axis of the propeller-shaft, by means of a second motor concentrically arranged about the first, so that the main motor system can be rotated in either direction at a fixed speed which is a simple multiple of the generator, and the speed of rotation of the propeller-shaft and of the propeller in the water is the algebraic sum of the rotation of the main motor and of the rotation imposed upon it by the auxiliary motor. Both motors being reversible there will be three speeds in each direction: Full speed, in which the main motor system speed is added to the auxiliary motor speed; half speed, when the main motor system is used only; and slow speed when the main motor system is running so that the speed of the auxiliary motor system is subtracted from it, *viz.:* the difference of the speed of the two systems. In examples given by the author, 840-shaft horse-power in ordinary reciprocating

engines and single screw the weight of the machinery and fuel is 570 tons, while with three oil engines, three motors and three propellers the comparative weight is 270, while, with coal at 20/- per ton and oil at 40/- per ton, the saving in fuel cost on a total of £17 would be £5/6/- per day at full power. Or looking at the question from another standpoint, a passenger vessel of, say, 16,200-shaft horse-power, the electrical equipment permits of a sub-division of the plant so that at ship speeds lower than the maximum only part may be run and that at full power, an advantage that is gained without loss in full power economy and without additional complication.

The Cowper-Coles Engineering Co., Ltd.—The Cowper-Coles Engineering Co., Ltd., now have their new works at Willesden in full working order, where they are making some of their specialities, such as pumps, injectors and valves for circulating corrosive liquors, a new form of sand blasting machine for the removal of scale and oxide from iron and steel, machines for welding aluminium, centrifugal filters and atomisers.

Death of a well-known Naval Architect.—We regret to record the death of Mr. Geo. Hepburn, which occurred in the early part of December at his residence at Liverpool. He was a distinguished member of the Institute of Naval Architects and of the Institute of Marine Engineers, and he had been the naval architect to many shipping companies in various parts of the country. He was celebrated as an expert in arbitration cases. His birthplace was Cults, Aberdeenshire, where he was born in 1841.

Instructions to Surveyors.—Motor Life-boats on Foreign-going Passenger and Emigrant Steamers.—1. Under the rule for life-saving appliances made by the Board of Trade, dated 24th May, 1909, a motor life-boat, approved by the Board of Trade, may be substituted for one of the boats under davits in the case of all foreign-going passenger and emigrant steamers which are required by the rules of 10th February, 1902, to carry more than four boats under davits. 2. Before a motor life-boat which it is proposed to carry under this rule can be approved by the Board of Trade, it will be necessary for the following conditions to be complied with, *viz.* :—(*a*) Particulars of the hull, machinery, oil tanks, and class of oil to be used in the motor should be submitted through the Board's Surveyors for approval. (*b*) The space occupied by the motor, petrol tanks, pipes, etc., should be at the after end of the boat, and separated from the space to be occupied by the passengers and crew by a watertight bulkhead ; but if it is desired to place the motor amidships, watertight bulkheads as high as the seats should be fitted at each end of the motor space. (*c*) If the boat is of wood, a metal tray must be fitted under the motor. (*d*) The ignition fittings and wires must be carefully protected against damp, so that they will be efficient after considerable periods of disuse. (*e*) The machinery should be fenced where necessary, in order to prevent injury to the persons in the boat. (*f*) The equipment provided must be the same as that required by paragraphs 5 and 6 of the general life-saving appliances rules for a life-boat of Section A or B. (*g*) Means for extinguishing fire must also be provided in accordance with the requirements of paragraph 23 of Circular 1466. (*h*) The buoyancy provided must be equal to that required for a life-boat of Section A or B. Additional buoyancy will be required for the weight of the motor and accessories, and for the boat, if built of metal, so as to provide buoyancy equal to that of an ordinary wooden life-boat of Section A or B. (*i*) The motor life-boat must provide ample accommodation for at least the number of persons that could be carried in the boat for which it is to be substituted, and for working the boat with the full complement of oars, or by sails. (*j*) Proper appliances must be provided on the ship for putting the motor life-boat overboard into the water quickly. (*k*) The instructions contained in Circular 1466 should be substantially complied with, but each case will be considered when the particulars are submitted.

MODERN SHIPYARD MACHINERY AND EQUIPMENT.

I.—Power Generation and Distribution.

It has in many ways been increasingly borne in upon British shipbuilders for years past that if they are to maintain, and even yet—if at all possible—to enhance, their long-lived reputation for skill and celerity in ship construction, it is an imperative necessity to generally modernize their works and bring them thoroughly up-to-date in all essential details of machine equipment. While pride of hand skill and deftness is still a factor in successful results it is as nothing in the working economy of modern yards compared with efficiency in mechanical operations. In spite of a strong disposition on the part of workmen—now happily less pronounced and crassly stupid than formerly—to regard mechanical improvements and innovations as being opposed to their interests—ingenuity and enterprise in enlisting natural forces have held on their progressive way until now, with the marvellous triumphs of electricity everywhere in evidence, even giant steam as well as pigmy man have had to bow, acquiesce and join in the strong march of development.

The main object in entering upon a series of illustrated articles on shipyard machinery and equipment is to bring before readers, directly and indirectly interested, some general account of what is most advanced in the way of machinery and appliances designed to take advantage, in the fullest and most effective manner, of the motive power systems now in vogue. Naturally, it will be necessary to treat, although in less detailed fashion, of the plant involved in the generation and distribution of the several distinctive systems to be seen in potent action in most of our larger and up-to-date establishments. The information to be offered in the course of the articles, while interesting those who in daily work are brought into close touch with what is most advanced in one or other, if not in all, the directions indicated, may also be suggestive to others on whom the work and responsibility devolves of converting or supplanting what is old-fashioned and inefficient into what is up-to-date. In long-established works, of course, the process of modernizing plant and methods is usually a lengthy as well as a risky process, and evolution in these days is so rapid and thorough that there is decided need for focussing attention on exemplar establishments and on the multifarious tools every day being invented, if not perfected and applied in practice. Changes in the character of the materials being dealt with, as well as modifications in the structural arrangements and methods of work in ship construction, are other influences constantly at work to bring about the introduction of new tools and appliances. It will be the aim throughout mostly to call attention to what is successful in practical every-day use or what gives strong and unmistakable promise of being so when adopted, and to offer accurate and well-confirmed information.

Steam, as may perhaps be shown later, has its own domain —still a large and vital one even in up-to-date shipyards—but gas and other internal combustion engines are invading the territory so long presided over. Electricity, however, is the great modern invader and conqueror, as no one need at this day be reminded, and co-eval—if not co-equal—with it in shipyard operations in many establishments are the powers of compressed air and hydraulics. It is to these features in shipyard economy one naturally first turns attention, and as representative of, or perhaps in advance of, general practice in the full utilization of all the powers mentioned the remainder of this first article will deal with power generation and distribution as recently put into full use in the works of Messrs. Harland & Wolff, of Queen's Island Shipbuilding Works, Belfast.

The central power station in the Queen's Island establishment, both as to housing and equipment, is suggestive of a power station of some great municipality, supplying the needs of miles and miles of populated radius, rather than of only one department—a vital one it is true—of a public works infinitesimal in comparison. As regards equipment, however, there is even more notable variety of plant than is to be met with in any power supply station connected with a city's needs. To suit all the varying demands of the multifarious

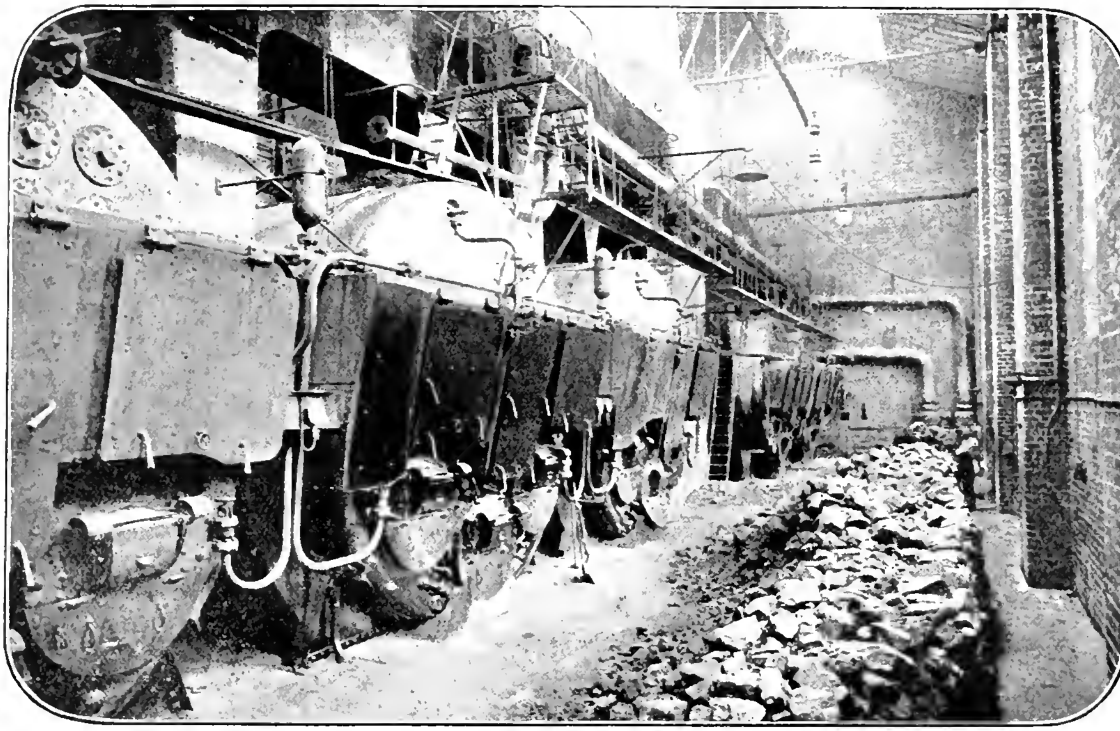


Fig 1 The Boiler House

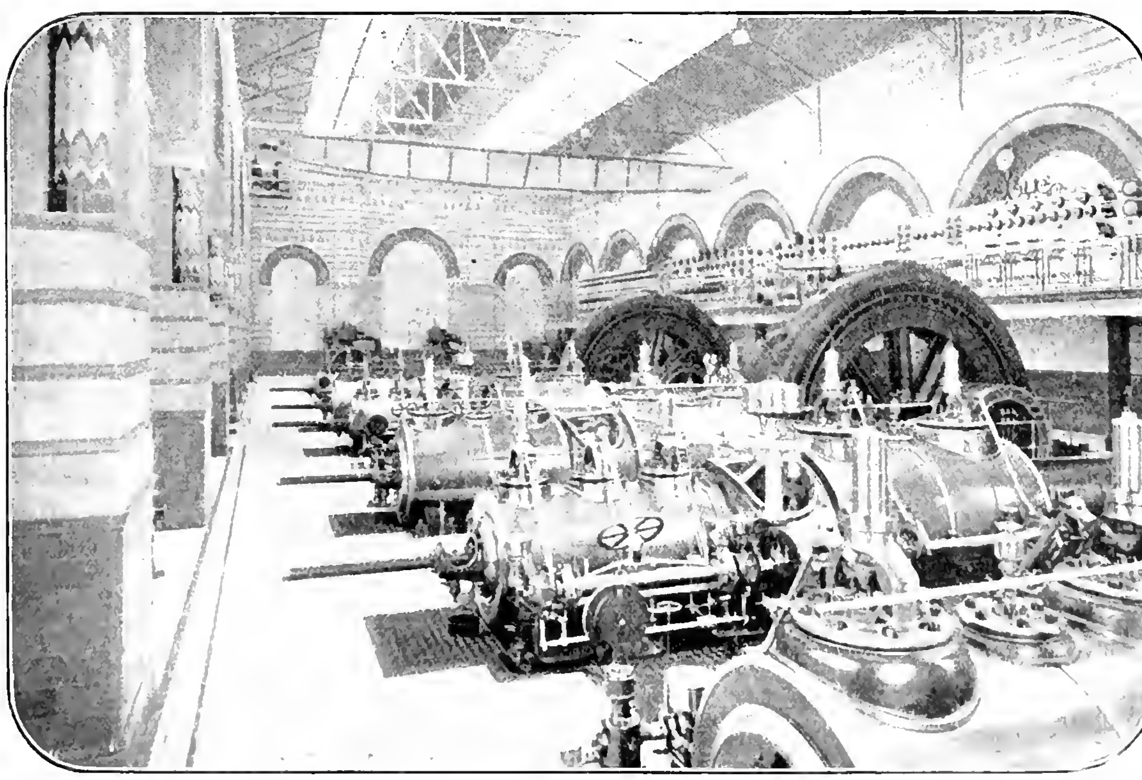


Fig 2 The Engine House
Messrs. Harland & Wolff's Works, Belfast.

tools and appliances, as well as lighting of shipyard and engineering works, both direct current and alternating current machinery are installed. Moreover, the four great systems of power creation and distribution are here co-mingled, and separately in evidence. The plant connected with the generation of steam, of electric, of hydraulic and of pneumatic power is all here to be seen, and of the most thoroughly up-to-date description. Taking, for example, the electrical installation alone, it contains 4000 kilowatts, or sufficient power—the whole of it being at work—to supply current enough to light continuously almost 133,000 eight-candle power incandescent lamps taking 30 watts each. Fully to appreciate what this means it may be stated that a well-known town with 300,000 inhabitants and an equivalent of some 120,000 eight-candle power lamps connected has a total capacity of but 4500 kilowatts. It is, moreover, a perfectly arranged plant, and it is run just as though it were supplying current for power and lighting purposes to a large town instead of just to one single works. The power station house consists of a main building 415 ft. long by 68 ft. wide and of an annexe measuring 136 ft. by 47 ft., is of red brick and of handsome design both inside and out, the interior of the engine-room being of specially graceful proportions and arrangement. The engine-room and boiler-house are separated one from the other by means of a substantial brick wall, through which there is only one small connecting doorway so that the dirt and dust of the boiler department are successfully excluded from the machinery section. The main boiler equipment (see Fig. 1) consists of five ordinary marine boilers manufactured by the firm, but in addition there are two marine type water-tube boilers, there being seven boilers in all, having a working pressure of 200 lbs. per square inch. All the return-tube boilers and one of the water-tube boilers, the latter being of the Babcock and Wilcox type, are fired by hand. Arrangements have, however, been made by which oil may be used as fuel, and all the necessary pumps and fittings and storage provided. The total heating surface of the seven boilers amounts to 15,435 square feet. In connection with one of the water-tube boilers it is worthy of note that it is specially adapted for consuming the refuse produced throughout the works and on board ship in the way of shavings, chips and sawdust. This refuse is collected and taken in carts to the boiler house and here it is elevated by means of an overhead traveller of two tons capacity to a sorting platform, arranged over a refuse destructor, where it is sorted and fed into a shoot leading down to the destructor furnace, which is of the meldrum type. The heated gases produced during the burning of it are utilized in the seventh boiler, which is of the Babcock and Wilcox type, and is provided with a superheater. The chimney to which all the flues from these boilers lead is of red brick, 180 ft. high and 8 ft. diameter at the top.

The engine house section of the station, 168 ft. long by 62 ft. wide, is brick-lined throughout, varied shades of brick being employed to give an artistic effect to the walls. Both by roof glazing and side windows the interior is copiously lighted and the impression gathered from the whole is one of light, spaciousness and dignity. The machinery equipment of the engine house, of which an illustration is given in Fig. 2, is very largely of continental origin, not through choice of the firm altogether, but mostly owing to the inability of British makers, through excess of work on hand, to furnish plant of the character in the time required. Reluctant as the firm were to meet their requirements abroad, it is but due to them and to the Continental firms they patronized to say that the plant is excellent and has given every satisfaction since it was put to work.

Claiming first notice are four main generating sets, the engines of which, made by Sulzers, of Winterthur, consist of four-cylinder twin, tandem, triple-expansion horizontal engines of the drop-valve type. The two cranks of the engines drive on to one crank shaft on which are mounted the electric generators. One of the latter is a direct current generator by Lahmeyer, of Frankfort, having a normal rated capacity of 1,000 kilowatts at 460 volts, the speed of revolution being 100 per minute. Other two of the four sets have each two generators on the shaft, one three-phase and one direct current, each of 650 kilowatts capacity, working at a pressure of 460 volts and a speed of 107 revolutions. The remaining main set of the four has only one generator on the shaft, being a three-phase, 650 kilowatt, 460 volt machine, similar to the others. Each of these four generating sets is provided with an electrical barring gear. Two other generating sets consist of three-cylinder vertical compound engines by W. H. Allen, Son & Co., Ltd., of Bedford, coupled direct on the same bed plate, in one case to a 350 kilowatt three-phase alternator, and in the other case (the shaft being prolonged in both directions) to a direct current generator, having four poles, generating current at 440 volts, and of a capacity of 342 ampères; and to a 120 kilowatt balancer, the two parts of which are rated 230 volts 261 ampères and 220 volts 272 ampères respectively. In proper juxtaposition are sets of exciters and boosters driven by engines of W. H. Allen's and Lawrence Scott & Co.'s make, also various sets of motor generators, the voltages of which afford a varied range for different purposes. Various other balancers and motor generators are included in the equipment, and over the whole length of the engine house is a 15-ton electrically worked overhead travelling crane.

With a station of such large capacity, and of such varied capabilities, there is of necessity a long switch-board, the mountings on which, on fine marble panels, are as simply arranged as the multiplicity of voltages, etc., permit. Here it may be stated that the lighting of the various shops throughout the works is controlled by switches on the board here and not on switches (except for sub-sections) in the shops themselves. A fixed regular schedule of hours of lighting up is adhered to. All the auxiliary equipment to the power station in the way of feed pumps, heaters, circulating pumps, condensers, etc., are located under the floor of the engine house, nothing of this nature appearing above.

Radiating from the electric generating plant to the various sub-stations and throughout the works are eighty-two separate circuits, and the whole network of mains totals over 500 miles in length. Nominally there are but three sub-stations, but at other points are extra sub-distributing stations. To the East platers' shed sub-station, for example, as many as eighteen circuits are run, and thence mains run to the North and West platers' sheds and to six of the building berths. Without a plan of the works—and perhaps even with it—it would be quite idle to attempt an adequate description of the wonderful network of cables spread throughout the works, overhead and otherwise, but it should be stated that for the use of ships being fitted out when afloat, cables are run overhead to the water's edge from the three sub-stations, and that both direct and alternating current are available from all sub-stations.

Of scarcely less importance in the economy of the Queen's Island Works are the two other great systems of power distribution, *viz.*, hydraulics and compressed air. In the generating of both these modes of power, of course, electricity is called into potent aid of its fellows. In this sense, as well as on account of the more restricted fields to which they are applied, the hydraulic and pneumatic power systems are secondary. Each, however, is possessed of advantages in kind and degree which the other cannot lay claim to, and at Belfast, as indeed in many other of our largest shipbuilding establishments, all three systems are found doing immense and concurrent service in clearly defined provinces.

The hydraulic and pneumatic power generating plant is contained in the large annexe to the engine house. Referring first to the compressed air machinery, some idea of its character and arrangement will be gathered from Fig. 3. There are three air-compressing machines of the Ingersoll-Rand Co.'s make, all driven by electric motors made by the Allgemeine Company, of Berlin. Two of the compressors are similar in size—capable of dealing with 2,425 cubic feet of free air per minute—and also in design, save that in one case the motor is of alternating, and in the other direct-current type. The motor is mounted centrally on a shaft having a crank at each end, one of which works the first-stage cylinder, 30 in. diameter, and the other the second-stage cylinder, 19 in. diameter, the stroke being 30 in. The air is delivered at 100 lbs. pressure into a large horizontal receiver supported on brackets on the wall. The action of the compressors is automatically controlled by the degree of pressure in the receiver. When this tends to increase above 100 lbs. per sq. in., a throttling device on the suction comes into play and air is prevented entering the cylinders. As soon as the pressure begins to fall below the 100 lbs., the air is automatically once more allowed to enter the cylinders. The third compressor is only capable of dealing with 700 cubic feet

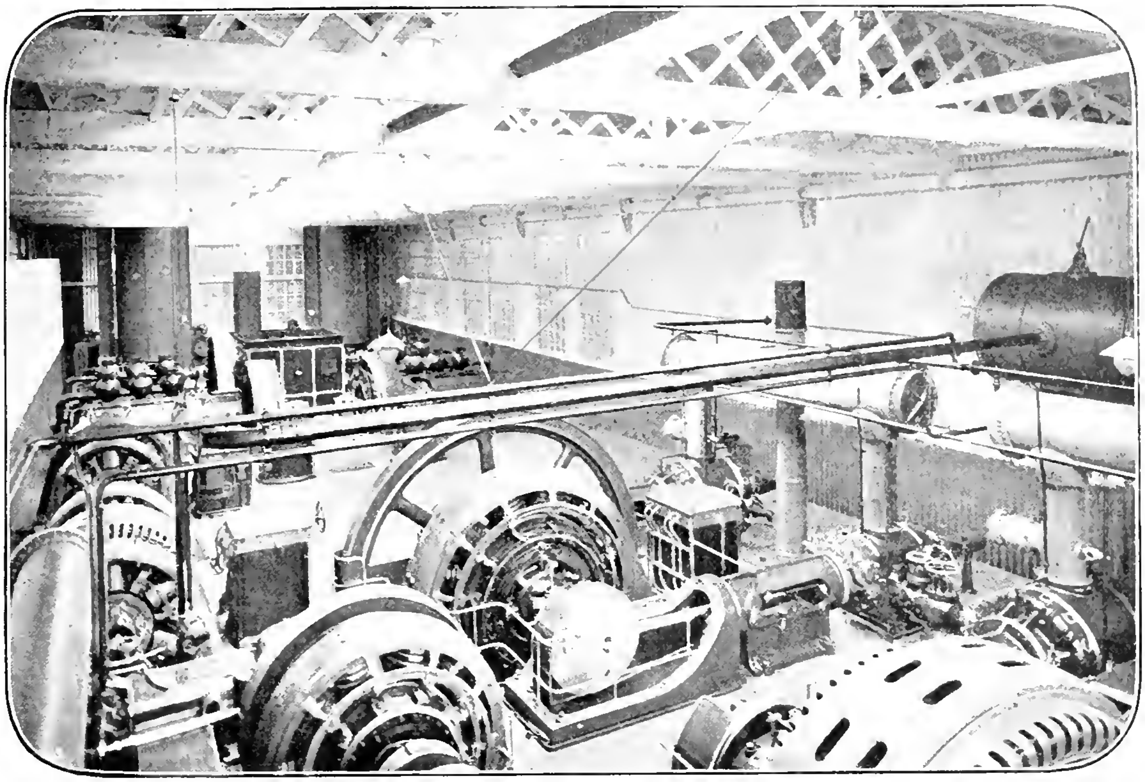


Fig. 3. The Pneumatic Machinery.

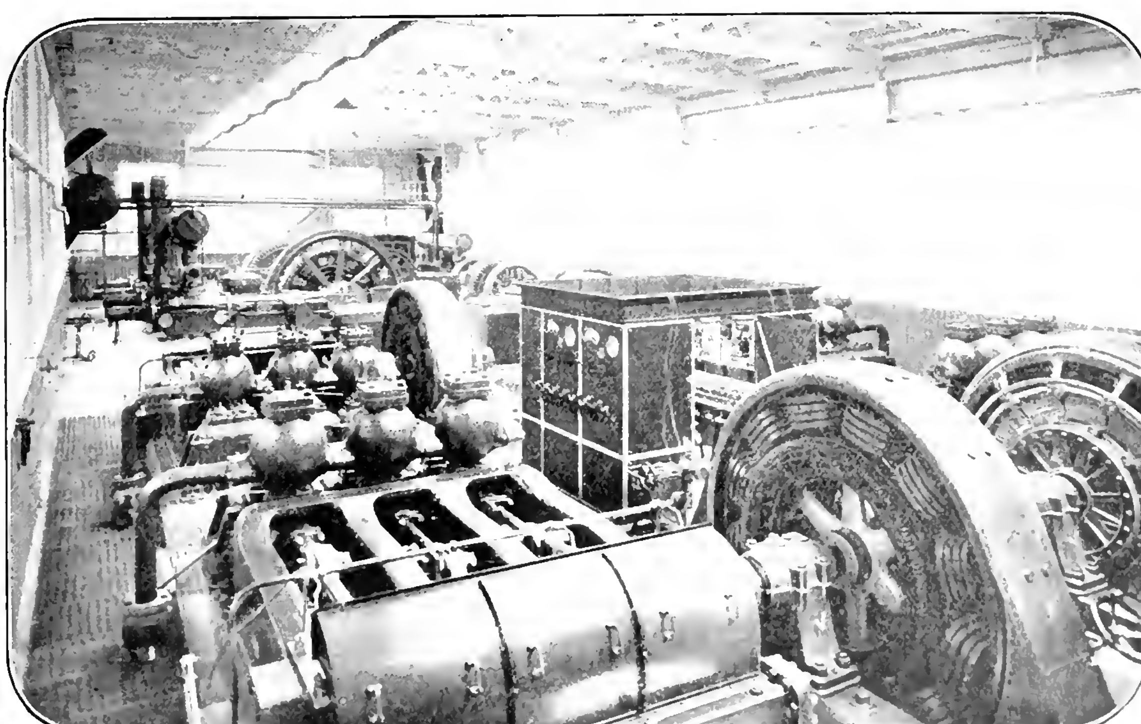
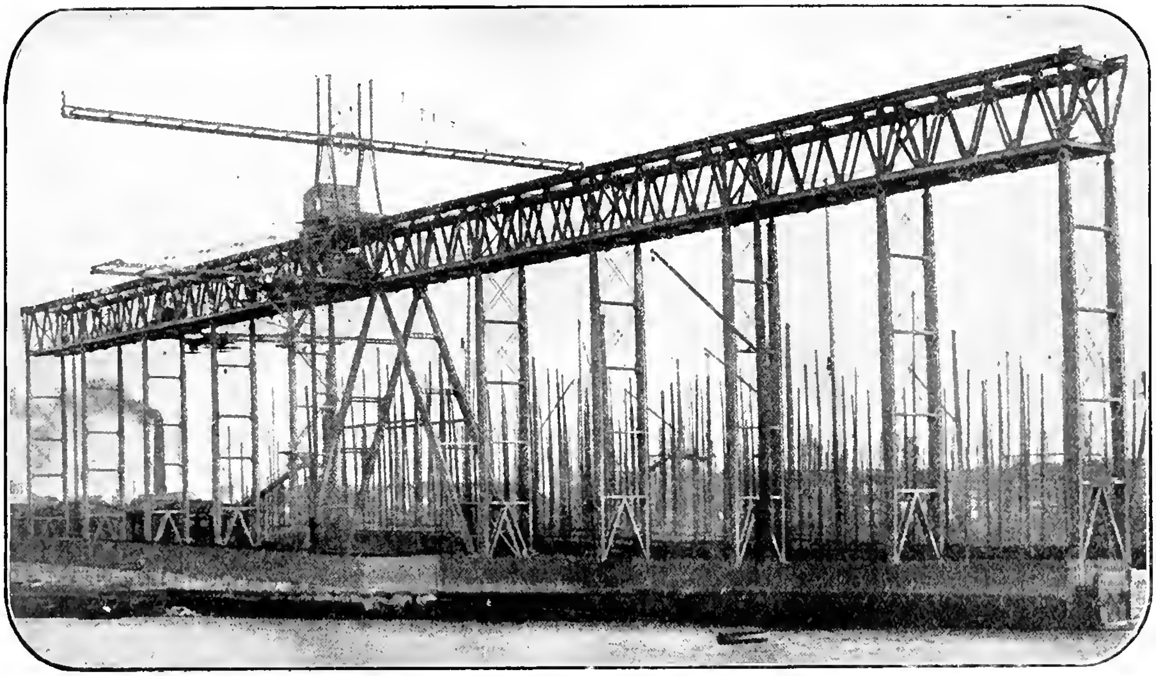


Fig. 4. The Hydraulic Machinery.
Messrs. Harland & Wolff's Works, Belfast.

of free air per minute, but is of similar design to the others and driven by a direct current motor.

The hydraulic pressure machinery, (Fig. 4) contained in the same apartment of the power house as the compressed air plant, is of special interest in that it provides for two distinct working pressures, 800 lbs. and 1,500 lbs. per square in. respectively. For each of these pressures there are two distinct sets of motor-driven pumps, automatically worked, one set always being in reserve. For the 800-lb. pressure there are two sets of single-acting three-throw plunger pumps of Sir W. G. Armstrong, Whitworth & Co.'s make. The plungers are 5 ins. diameter and have a stroke of 20 ins. When working at the full speed of 60 revolutions per minute, each set delivers 250 gallons of water per minute. The pumps discharge into an accumulator, weighted so as to give 800 lbs. pressure, the plunger having a diameter of 20½ ins. and a total lift of 20 ft. The two sets of 1,500 lb. pressure pumps are similar to the foregoing, the plunger being 3½ ins. diameter with 20 ins. stroke. The capacity of these, at the pressure stated, is 130 gallons per minute, and they discharge into an accumulator having a plunger of 20 ft. lift, but of only 15 ins. diameter. All the four sets of pumps are driven by multipolar direct-current shunt-wound machines of 200 brake horse power, when working at their full speed of 60 revolutions per minute, supplied by the Allgemeine Co., of Berlin.

(*To be continued*).



Shipbuilding Ganting over Berths 5 and 6
Messrs Harland & Wolff's Works, Belfast

BUREAU VERITAS report Maritime Casualties during October as follows: Total Losses:—Sailing vessels, 48, of all nationalities. Steamers, 30, of all nationalities. Causes of Losses:—Sailing vessels.—Stranding 20, Collision 2, Fire 2, Foundered 4, Abandoned 6, Condemned 14; Total 48. Steamers.—Stranding 9, Collision 3, Fire 5, Foundered 3, Condemned 10; Total 30. Accidents:—Sailing vessels.—The following casualties are reported: Stranding 25, Collision 52, Fire 3, Leaky 23, Stress of weather 72; Total 175. Steamers.—Stranding 103, Collision 113, Fire 27, Leaky 8, Stress of weather 64, to Engines and Boilers 63; Total 378. Vessels surveyed and classed by Bureau Veritas from October 20th up to November 19th, 1909:—Sailing vessels, 88; Steamers, 143; Total, 231.

INSTITUTE OF MARINE ENGINEERS.—On the kind invitation of Messrs. The Diesel Oil Engine Co., Ltd., several members of the Institute of Marine Engineers made a trip on December 4th on the Company's demonstration boat, driven by a 100 h.p. reversible crude oil engine. The vessel left the Waterloo Pier and made the journey up and down the river between the Westminster and Tower Bridges, easily responding to the various operations of slowing and reversing the engines.

INSTITUTE OF MARINE ENGINEERS.—At the Institute of Marine Engineers a lecture was given recently by Mr. A. T. Strohmenger, F.I.C., on "Notes on Coverings for Boilers and Steam Pipes." Mr. John Lang, R.N.R. (Member of Council), occupied the chair. In the course of his lecture, Mr. Strohmenger said it could be safely assumed that the losses through direct radiation from conveyors carrying heat energy in the form of steam were exceedingly small. From an uncovered boiler or pipe the losses were undoubtedly primarily due to conduction and convection. Convection was merely the hustling of heated particles due to a difference in the specific weight or volume. When the vessel carrying heat energy was lagged, convection was minimised, but, in his opinion, conduction was increased. It was generally stated that the more air cells present in a covering, the more efficient would be the covering. Although this was true, he wished to make it clear that it was not because of the air cells, but because of the longer path and therefore increased resistance of the material used. Laggings in practical use might be divided into four classes. One of these was the sectional form, which were shaped before being applied and bound into place, generally by strips of metal. In the mattress form, the covering was the part which suffered most in competition; in some cases it contained as much as 25 per cent of combustible material. The material used for filling the mattress should be long fibre asbestos. The efficiencies obtained for magnesia sectional covering and for blue asbestos mattresses were practically identical; the greater resiliency of the blue long fibre asbestos made it a better insulator than the white asbestos. Rope covering was particularly convenient for pipe coverings; it was important, in this form of covering, to have the plaiting as loose as possible. For permanent work the plastic form of covering was often economical, but as its removal entailed

the destruction of the covering the economical consideration was governed by the permanency of the job. The properties of a desirable covering might be summarised as follows: It should offer a high resistance to the passage of heat; it should be capable of being easily removed; its efficiency should not be impaired by variations of temperature, the action of steam or water, vibration, rough handling or physical or chemical changes over a term of years; its specific weight should not be so high as to place an undue strain on the steam pipes; it should have no action on the metal surface lagged; it should be non-inflammable; its specific heat should be as low as possible. In the discussion which followed Mr. F. M. Timpson asked whether the blue asbestos was more porous than white. Magnesia coverings, in his opinion, gave good results. Mr. Jas. Adamson said that there had been instances where the non-conducting material on pipes, when mixed with sea water, had affected the pipes very detrimentally. One great trouble was to get a covering for deck pipes which would withstand the rough usage they received. Cork and diatomite were both substances which had given good results as insulators, and they lasted for long periods. Mr. T. Horsnell asked whether the absorbent nature of the asbestos mats would not prevent the detection of leaks in the boiler. The crystals in the magnesia, in his opinion, had a tendency to separate owing to the vibration, causing depreciation, and in this respect he considered the plastic form of covering had an advantage. Mr. Wm. Walker gave figures relating to an official test of covering after a two-hours' run on a range of steam pipes, which showed that the heat lost per hour per sq. ft. of radiating surface, when bare, was 2·88 B.Th.U., and when covered it was ·348 B.Th.U. There was 87·9 per cent less condensation per sq. ft. of covered surface than with a similar amount of bare surface. The chairman said he did not agree with the lecturer as to the corrosion caused by boiler coverings, as in one instance the covering was removed after having been on for fifteen years and no trace of deterioration was observed. Mr. W. Lawrie deprecated cork as an insulator on account of it carbonizing so quickly; and Mr. A. E. Rowe gave an experience of corrosion in a copper deck pipe, which he said was ascribed to the covering used. In replying Mr. Strohmenger said that although the blue asbestos was more resilient it did not necessarily follow that it was more porous than white. The good results obtained from the use of diatomite depended very often on the binding materials with which it was mixed. The objection to cork as an insulator was that it shrank a good deal and more or less oxidized in time, thus becoming a fairly good conductor. When mats were used leaks in the boiler could be instantly detected, as the water would become apparent immediately at the spot where the leak occurred. Fibrous materials depreciated to some extent due to the vibration, and in that respect plastic covering was superior. There was absolutely no reason to think that pure asbestos would have a tendency to corrode metals, and if this occurred at all it was most probably due to the presence of impurities. A hearty vote of thanks was accorded to Mr. Strohmenger and to the chairman.

The Waratah.—A public meeting has been held in the Town Hall, Melbourne, to urge that a further search be made for the missing liner *Waratah*. A strong committee has been formed and over £2,500 subscribed. The Victorian Government subscribed £500, and a similar sum has come from South Africa.

The River Wear Commissioners report that during the year they have constructed the south-west breakwater and the round head and breakwater. They have reconstructed the greater part of the old North Pier and part of the South Pier. In addition they have built a new baling house for H.M. Customs and completed the deepening of the river at the Hetton and Lambton Spouts and have removed about 30,000 tons of solid rock from the berths and fairway. The fairway under the Wearmouth Bridge has been made 20 feet deep and the width doubled, and at least 20 feet has been given the berths higher up the river. The chief work of the year has been the new deep water channel. It is a mile long and has been formed by the removal of 276,000 tons of material, of which 27,000 tons was rock.

DOUBLE BOTTOMS IN MODERN STEEL VESSELS.

We do not know to whom the idea first came to run water into the bottom of vessels for purposes of ballast. It is one of those ideas, the chief effect of which is to make one wonder why it was not thought of before. The expense and inconvenience of shipping large quantities of sand and rubble ballast would, one would imagine, have constituted a most powerful inducement towards the devising of some alternative scheme whereby such expense and inconvenience would have been avoided. That the easy expedient of running water into specially prepared compartments in a vessel was not sooner thought of is one of those things which must appear stranger to us, naturally, than to our predecessors.

So soon as it was thought of, however, the idea took root and rapidly grew; and, as we should have expected, we find then that vessels already built were converted to carry this water ballast. The method adopted was to fit longitudinal girders upon the tops of the ordinary transverse floors. These girders supported the tank top plating, which was fitted transversely, and a water-tight construction was fitted at the boundary of the tank at the side of the vessel. The longitudinal girders above referred to were spaced about three feet apart, and their depth was such as to admit of easy access to the interior of the tank. This arrangement, which is familiar to readers, and known as the McIntyre tank, had several obvious defects. The tank top plating was not adequately supported, and it was found that, with the girders spaced three feet apart, the plating bulged very appreciably between them when the tank was tested. The connection of the longitudinal girders to the floors also was not very efficient. This was effected by riveting the double angles fitted on the lower part of the longitudinal girders to the reversed frames on the top of the floors. It was found necessary in some cases to fit vertical angles at each floor so as to obtain sufficient rivet area. The water-tight connection at the side, too, was awkward and expensive, and altogether, in view of these defects of design and difficulties in practice, it is not surprising to find this method of construction was almost entirely discontinued in new vessels of any size.

The forms of construction that took its place were, however, influenced by it in several respects. Longitudinal girders were still fitted, and the height of the bottom approximated to what it had been under the old system. These improved methods are of two well-known types, which have continued until the present day with very little alteration indeed. In the first of these a solid floor-plate is fitted at every frame extending from the margin plate to the centre girder, with one, two or three longitudinal girders on each side, according to the size of the vessel. The tank top plating is, of course, worked longitudinally. In the second type the solid floors are fitted at alternate frames, and the number of longitudinal girders is usually one more than in the case of the first type. Between the solid floors are fitted a frame bar and reversed frame bar, attached to the outer and inner bottom plating respectively, extending from the centre

line to the margin plate, and connected at these places by means of brackets. These two methods of construction have been persisted in till the present time, and it may not be therefore out of place to discuss them briefly from the point of view of economy and of strength.

The first consideration that appeals to us is that by reason of the construction here adopted we have a much greater margin of strength than at any other part of the vessel. We have here the equivalent of a double skin, each strongly attached to the other by an efficient system of interdependent girders. For withstanding transverse stresses, under any assumed conditions the bottom is very much stronger than the side. Before it became usual to fit double bottoms, ships did their work fairly satisfactorily with a certain thickness of bottom shell plating, and when double bottoms *were* fitted this thickness was not materially altered. A slight concession was made to vessels having floors fitted to every frame in the shape of a reduction of $\frac{1}{20}''$ from the thickness of two or three strakes of bottom plating on each side. Thus the fitting of the inner bottom plating (although it is included, and rightly so, in every moment of inertia calculation for the midship section) was not conceded, broadly speaking, to be a reason for reducing the shell. It may shrewdly be suspected that this was a consequence of fitting tanks in vessels already built, in which, of course, no reduction could be made, but whether this is so or not, it is none the less true that we have here a substantial margin of structural strength.

In resisting local deformation also the bottom is much stronger than any other part of the vessel. Not only have we strong floor plates every two feet or four feet apart, approximately, but these are crossed by strong fore and aft girders. At the point where the latter cross the former there is exhibited a cruciform section capable of developing enormous resistance to compression. Of course, when speaking of local deformation, one must be careful to specify under what conditions local deformation is supposed to take place. There are those who contend that the bottom of a ship should be strong enough to "smell," or slightly to touch, the ground without damage. We must say that provision against this eventuality does not appeal to us as being reasonable. Ships should be designed to meet the ordinary exigencies of deep sea traffic, and the design should not be affected by the necessity for providing against damage of the above nature. Apart from that, it is impossible to have any definite standard of strength on that basis, for we do not know what is involved by "slightly" touching ground to ships of different displacements; and, if we did, the provision which would be sufficient for scraping against a bottom of soft sand would obviously be insufficient when that bottom is rock. For these reasons it is preferable to apply to the bottom the standard applied to other parts of the structure, and if that be done the excess of strength existing here over these other parts can easily be demonstrated.

The second consideration that appeals to us when examining the two popular methods of double-bottom construction is that there does not appear to be a satisfactory and logical relation between the strengths of the two systems. In a vessel with the transverse rigid sections—bulkheads—spaced the usual distance apart, and considering the floors and longitudinals as series of girders which support external loads in proportion to their stiffness, it will easily be seen, having regard to their respective lengths, that the floors support a much greater part of the external or resultant load than do the longitudinal girders. In fact, in many cases the proportion of the load supported by the girders and transferred by them to the rigid abutments at the ends of the holds can be neglected, yet when floors are fitted to alternate frames, and have loads not much reduced from those in the former case incident upon them, we find that these floors are of the same scantling as when spaced twice as closely. Not only is this so, but the intermediate plating is supported by bars whose rigidity cannot be compared with the rigidity of a solid floor plate, and it has been the custom to allow the reversed frame to be dispensed with in consideration of a small addition ($\frac{1}{20}''$) to the thickness of the inner bottom plating. In the case of a vessel being docked also it is easy to see that the stresses in way of the keel blocks will be more severe in the one case than in the other. It is, perhaps, needless to labour this point of the disparity in strength of the two systems, but the fact that it exists in vessels supposed to conform to a uniform standard seems to point to the necessity for a thorough examination into the scantlings of the material employed in this part. This examination has already begun, and signs are not wanting that there exists a considerable volume of opinion that substantial reductions can be made in these scantlings. This tendency to reduce double-bottom scantlings is, of course, periodic, as all who are acquainted with the history of the subject know, but at no past time has attention been concentrated so keenly on this aspect of the question as it is now. Several notable schemes have recently been propounded with this object, but a discussion of these and of their practicability must be reserved for a future occasion.

THE LATE MR. SYDNEY SMITH.—A portrait of the late Mr. Sydney Smith, of Nottingham, who died in 1882, has recently been presented to the Institution of Mechanical Engineers by his grandsons, who are associated with the firm of Messrs. Sydney Smith & Sons (Limited), of Nottingham. The portrait is accompanied by descriptive drawings of the first steam gauge, which was one of the most important of Mr. Smith's inventions, others being a rotary steam engine, a rotary stocking frame, a spring safety valve, a self-acting damper regulator, and a portable gas apparatus.

MESSRS. LEONARD CHAPMAN & CO., Importers and Manufacturers, Munton Road, London, S E., report:—Graphite, as imported, according to quality:—

Ceylon L.L. c i.f. London	£25	0	0	to	£47	0	0	per ton.
,, O.L. ,,	18	0	0	to	46	0	0	,,
,, chips ,,	14	0	0	to	33	0	0	,,
,, dust ,,	9	10	0	to	25	0	0	,,
Purified, milled and ground.								
Ceylon, 97% to 99%, f o.b. London	59	0	0	to	63	0	0	per ton.
,, 90% to 91% ,,	40	0	0	to	42	0	0	,,
,, 80% to 81% ,,	30	0	0	to	32	0	0	,,
,, 70% to 71% ,,	27	0	0	to	28	0	0	,,
American large flake, f.o.b. London	45	0	0	to	49	0	0	,,
,, small ,,	35	0	0	to	45	0	0	,,
Graphite Joint Compd. ,,	2	9	0	to	2	12	6	per cwt.
Graphite Paint Paste ,,	2	2	0	to	2	5	0	,,
Graphite Paint ,,	0	4	9	to	0	5	3	per gal.

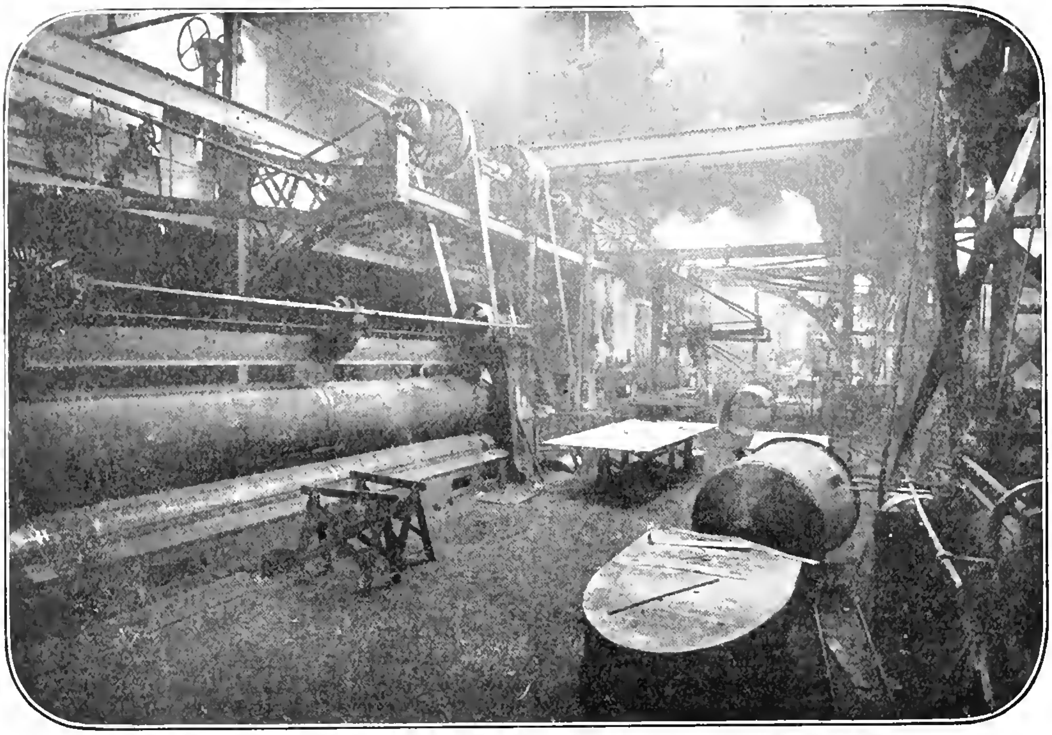
Wholesale list of tinned goods on application.

MESSRS. BÉLIARD, CRIGHTON & CO.'S REPAIRING ESTABLISHMENT AT ANTWERP.

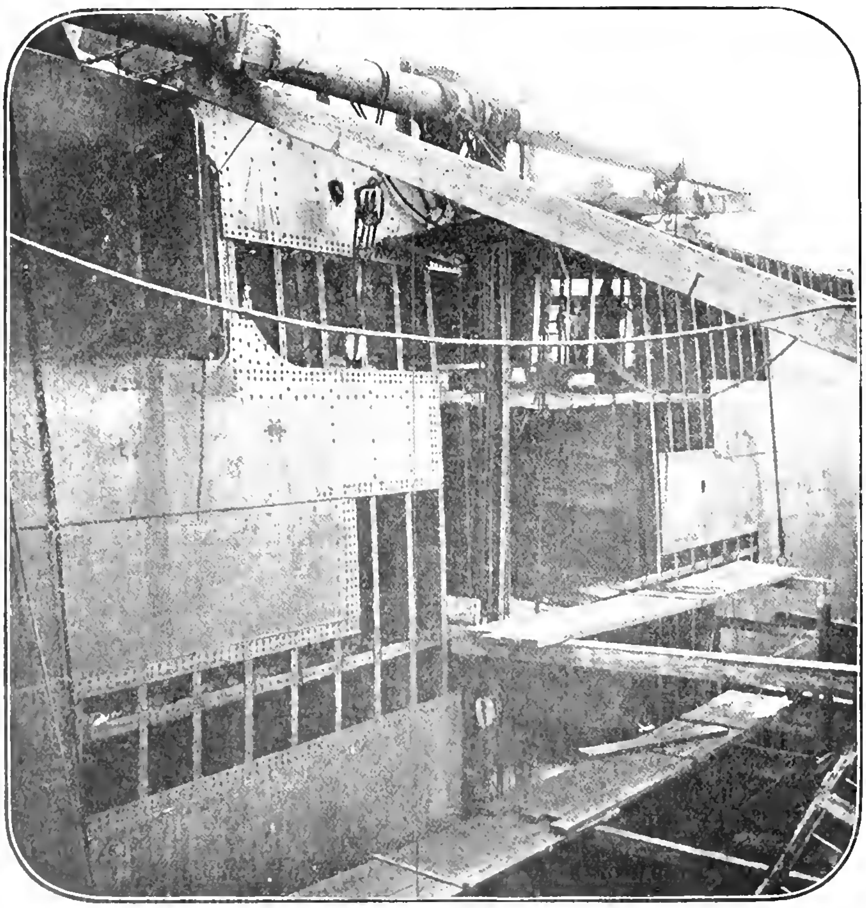
THE progress and development of Antwerp during recent years has been considerable, and quite in keeping with its earlier traditions, for its history dates back some twelve hundred years, while four hundred years ago its population and influence proclaimed it to be a city of importance. It fell behind its rivals for a time, but reasserting itself, we now find Antwerp once more in the front rank and one of the most important seaports on the continent of Europe. The attractions of Antwerp to the visitor are many: the Cathedral, the ancient buildings, the art galleries with their masterpieces of work are well known and always yield pleasure and solace from the exactions of business. The arrangements in connection with the docks, discharging, loading and storing of cargo, shifting ship, leave much to be desired, and probably the abnormal development has contributed to the lack of desirable facilities in some directions due to the rapid increase in wants which time has not yet permitted to supply. That the authorities are alive to the requirements is evident from the works in progress around the docks.

It is with some degree of pleasure and satisfaction that we find the repairing establishments keeping abreast of the times and the growth of the port. The illustration shows the works of Béliard, Crighton & Co., Batavia St. They are well situated and equipped for dealing as well with ordinary repairs as with those of a character demanding urgent and immediate attention. The calls made upon a repairing workshop are such that without the most up-to-date appliances it is impossible to keep abreast of the requirements. The oxy-acetylene plant, to which we have formerly referred, and other means for minimising time and labour are necessary adjuncts to such works and Messrs. Béliard, Crighton & Co. were among the first to recognise the value of the application of the swift cutting action of the oxy-acetylene process, and adopt it for this purpose, while the value of autogenous welding for dealing with defects whether due to cracks or wastage of materials has also been used to a considerable extent and with satisfactory results. The illustration shows the *Marina* in course of repairs of damage due to collision with the *Ettrickdale*, off Flushing. These repairs, which involved the renewal of twelve entire lengths of frames, thirty plates and the stringers on the three decks, were undertaken by this firm. As the engine room was cut into, the auxiliary machinery had to be disconnected for the time being and refitted, also engineers' cabins reconstructed. The more recently damaged *Presto* also the result of collision is, while we write, being repaired and fitted with a new bow. The *Cap Spartel* is shown having the stern frame and rudder and thirty bottom plates renewed, also the propeller and shaft. The damage to this steamer was due to grounding off Calais; the vessel was got off and towed to Antwerp, where the repairs were accomplished in twenty-two days. Another notable repair, necessitated to the *Schaldis*, on account of a collision in the river, including new stem, nine frames, fore part of deck and twenty-four plates, was overtaken in fourteen days. The overhauling of the Belgian Government mail boats is entrusted to this firm, and the illustration of the *Princesse Elisabeth*, the Ostend Dover turbine mail steamer, which was built at Hoboken, shows this vessel in course of overhaul in dry dock. Boiler plates, tested,

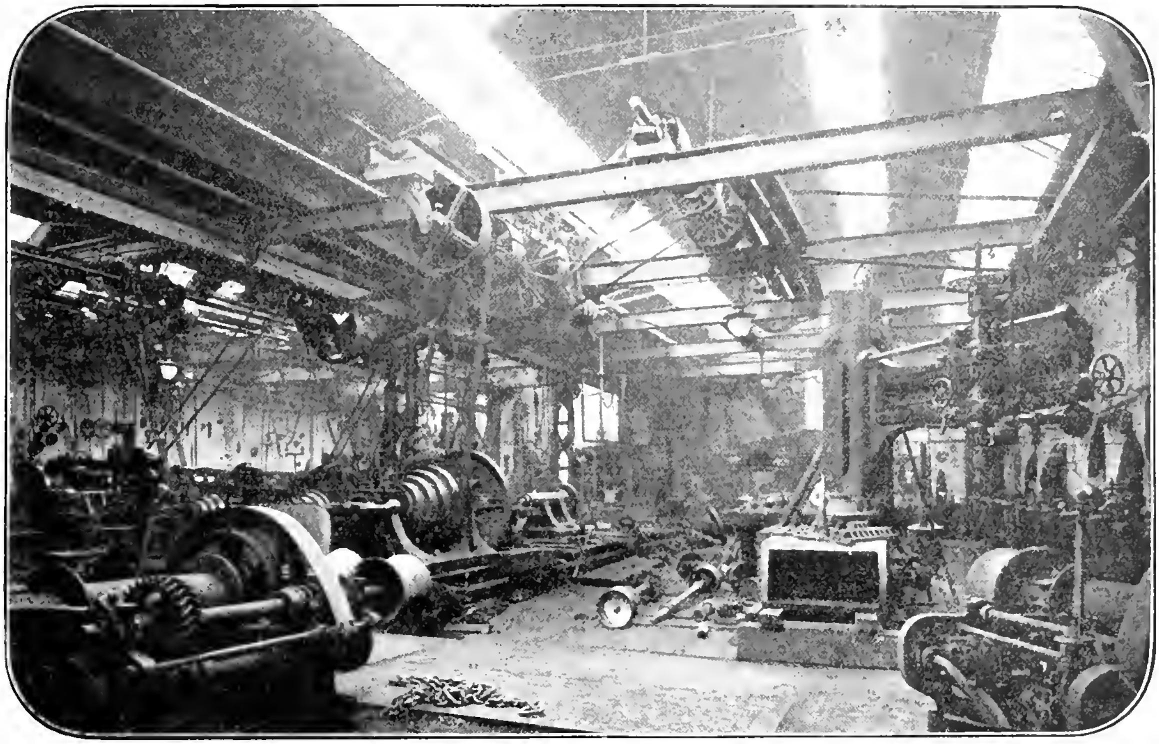
Messrs Béliard, Crighton & Co.'s Repairing Establishment at Antwerp



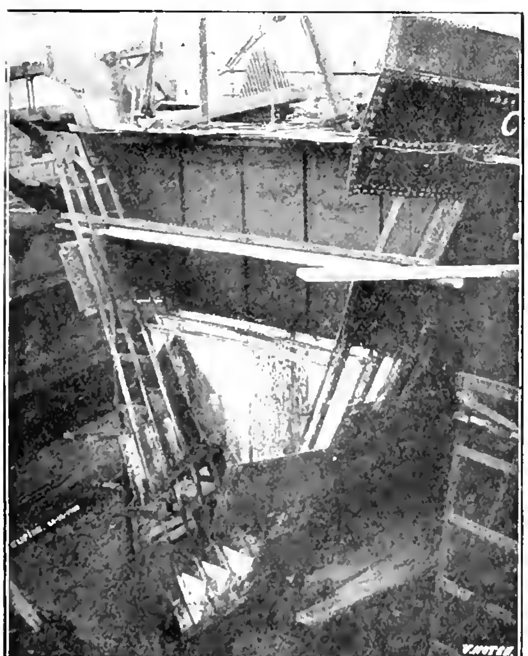
Boiler and Plating Shop.—Messrs. Béliard Crighton & Co., Antwerp.

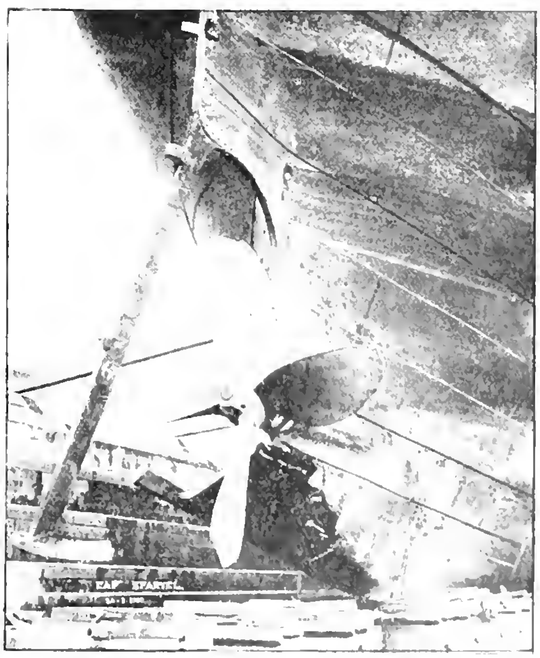


The s.s. *Marina* in course of Repair.



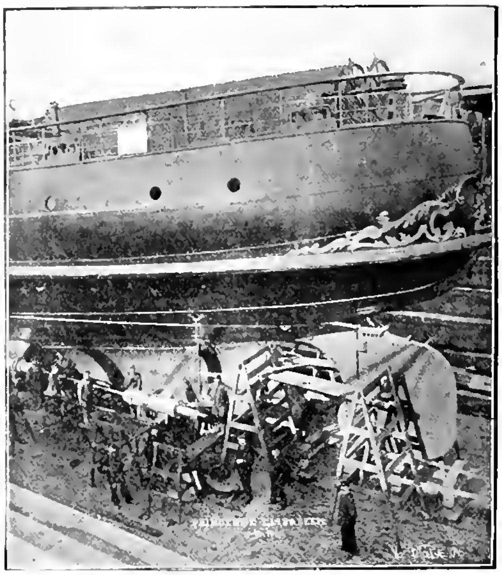
Fitting and Machine Shop
Messrs. Béliard, Crighton & Co., Antwerp





Repairs undertaken by Messrs. Béliard, Crighton & Co., Antwerp

stamped and certified, are kept in stock ready for emergencies, and the large number of machines in the machine shop show that detail work can be treated with despatch. The machinery is driven by means of a suction gas engine, which gives a decided economic advantage, as it can be started for work on short notice.



The *Princesse Elisabeth.*

In order to facilitate work found necessary in dry dock, there is a branch of the establishment in the neighbourhood of the Dry Docks fitted to deal with the ordinary repairs incidental to dry docking.

We were witness to some of the work being dealt with and found the organization to be well systematized to ensure prompt attention to details.

OZONAIR APPARATUS.

In our issue of November we gave a full description of the generating apparatus made by Ozonair, Ltd., of 96, Victoria Street, Westminster. We desire to draw attention to the magnificent show-rooms that have been installed by this Company, and of the interesting sets of apparatus in great variety which are exhibited therein. We feel satisfied that a visit paid to these show-rooms by any one who is interested in this class of apparatus will be well repaid for their pains.

New Thames Wharf.—Approval was given by the Commissioners of Sewers for Dartford and district, at a meeting held recently, to a scheme for the construction of a deep-water wharf at Long Reach, near Dartford, with a view to relieving the congested state of the Thames. The new wharf is to be 3,600 feet long and 50 feet wide. Great interest is being manifested in the scheme by the local authorities in the district, and it is stated that the work will commence shortly.

Messrs. Denny, Mott & Dickson's, Ltd., Wood Market Report states business has been very quiet during November, and this state of things promises to continue until the political crisis has been terminated by the result of the expected elections this month.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The December Hurricane.

The great gale at the beginning of December will long be remembered by all those who were exposed to its force, and even by many who only heard its roaring from their comfortable beds. Perhaps it may be admitted that the damage as yet attributable to its violence is less than might have been anticipated, for as the years go on, and as the shipbuilder's art becomes more and more perfected, the losses due to stress of weather become less and less in number. The gale, however, claimed its direct victims, as in the case of the fine cargo steamship *Thistlemor*, of Sunderland, which foundered, clearly through stress of weather, off the Devonshire coast. The circumstances attending the loss of this vessel were exceptionally sad. The steamer, a new vessel of over 4,000 tons gross register, was not suddenly overwhelmed, but though obviously doomed, remained afloat throughout that terrible night, the crew burning flares and doing everything in their power to summon assistance from the land which was so near them. Their signals were, however, unanswered, and twenty-one lives were lost. Indeed all hands would probably have shared this fate, had it not been for the bravery of those on board a passing steamship, the *Arndale*, outward bound from Barry. By this means nine survivors, including the chief engineer, Mr. Stephenson, were rescued from certain death. The *Arndale* put back to port with the rescued men and landed also her second officer, who had sustained a broken leg in effecting his share of the service. But the whole machinery on which the country relies for the protection of vessels found in distress off its coasts failed most lamentably. Much local feeling has been aroused in Devonshire, and a demand has been made for a Government inquiry to emphasize the defects of the present system and to find out means whereby the repetition of such incidents may be avoided in the future. It is pointed out that the changes which are being effected in the numbers and disposition of the coastguard by the Admiralty tend to make the watching of the home seas less and less complete, whilst at the same time it should not be forgotten that though the Coastguard do take notice of vessels in distress, their primary business is the guarding of the shores from hostile attack and the prevention of smuggling. The worse the weather the greater, of course, the probability of disaster. But when the weather is really bad, the chances of landings by smugglers become more remote, and for that reason the nights when wrecks are likely to occur are precisely those on which a look-out for smugglers is least necessary. It is said that arrangements have been made by the Board of Trade by which the duty of keeping an observation for wrecks has been taken over by civilians. This, however, cannot be a satisfactory solution of the difficulty, for farmers and their hands are not qualified—as are men trained to the sea life—to observe and recognise the meaning of such lights as may appear.

The loss of the *Ellan Vannin*, of the Isle of Man Steam Packet Company, is a much more tragic affair, for a strong element of mystery is imported into it, and the disaster bids fair to be one whose details will never be known. The *Ellan Vannin* was a small steamer built as long ago as the year 1860 by the famous but extinct firm of Messrs. Tod & McGregor, on the Clyde. Her original name was *Mona's Isle*, for she was launched as a paddle steamer for the mail and passenger service of her owners. In the year 1883, however, she was re-built and fitted with new boilers and a pair of compound engines driving twin-screws. Her name was then changed and her occupation since that time has been in the subsidiary services of the Company, her small tonnage—for she was only of 380 tons gross register—being obviously such as to render her unfit to cope with the vastly increased passenger traffic of the line. So she ran on such services as that on which she was lost—the voyage between Ramsey and Liverpool, where few passengers offer themselves, but where—there being a mail to be carried—regularity of despatch and arrival is of the utmost importance. All that is certain about the catastrophe seems to be that the ill-fated vessel left Ramsey at about one o'clock on the morning of Friday, the 3rd December, and that soon after

sailing the Irish Sea was swept by the disastrous gale which we all remember, and that in the course of the day her masts were seen about 1,200 yards distant from the Bar Light-ship off the mouth of the Mersey. Wreckage coming ashore proved her identity and the fact that it was found so soon after her loss seemed to show that, in spite of weather conditions, she had made her voyage in excellent time, so that almost to the last those on board of her had no reason to suspect the fate which was in store for them. Divers have since examined the wreck, which is listed some fifteen degrees, and is now sinking into the sand and mud. Their report shows that the *Ellan Vannin* is broken in two pieces and that there is on the port side every appearance to indicate that she was sunk by collision, the plating at the wound being bent inwards. But beyond the damage on the port side there is also injury on the starboard bow. The latter circumstance, coupled with the fact that there has to the time of writing been no report of any vessel which would point to a collision—in this case—has given rise to a theory that the vessel may have been lost by contact, not with another ship, but with a fixed object, probably the base of the new *revetment* works at the river bar, upon which the engineers of the Mersey Docks and Harbour Board are now engaged. The divers further report that the davits of one of the starboard boats are swung out. Indication is thus given that there was an interval of some duration between the time the *Ellan Vannin* sustained her death wound and the moment at which she sank. How long that interval may have been cannot, of course, be ascertained. But the fact that it existed, and that she would be moving as long as she remained afloat, makes it impossible to judge from the position where she now lies of the actual place at which the injury was sustained.

It should be noted that though the Isle of Man Company began its work as long ago as, I believe, the year 1829, this is the first time it has lost a vessel. Considering the stormy nature of the Irish Sea and the inhospitable character of the Manx coast—where wrecks are so frequent—this is a marvellous record. Nor should we imagine that the small size of the *Ellan Vannin* in any way unfitted her for her work. Those who have experience of cross channel mail services will remember the *Foam*, the *Breeze* and the *Maid of Kent* on the Dover service. These were vessels, small by modern standards, built in the early sixties. Yet till comparatively recently they were the vessels that were relied on to carry the mails on the stormy nights when it was inexpedient to send larger vessels across the Channel.

The Union Castle Line's
old steamship the *Raglan Castle*, which for a short time subsequent to her departure from the Company's fleet was known as the *St. Domingo*, has been acquired from Messrs. Barclay, Curle & Co., her builders and present owners, by the Donaldson Line. In her new employment she is to take the place of the *Hestia*, wrecked in the Bay of Fundy in October. She will now be known as the *Pythia*. It may be recorded that as regards the loss of the *Hestia*, there have been statements made as to the unfortunate circumstances in which that vessel went to her destruction. It appears that those in charge of the steamer's navigation, having sighted the Gannet, were proceeding in the expectation of picking up the buoy on the Old Proprietor Ledge. Neither the light nor the fog signal for which they were looking was at work, and as the result the ship was piled up on the rocks they were trying to avoid. This fact, if it stood alone, would have been bad enough. But a further aggravation of the matter is alleged in that it is said that the keeper of the Gannet Light refrained from firing his warning gun to apprise the *Hestia* of the fact of her danger; the reason for his omission being that he was afraid the signal would disturb the doctor on shore! One can hardly believe that these statements are not at all events exaggerated. But we shall soon know what foundation they have, for an investigation into the whole circumstances of the case will be held by the Canadian authorities.

The Harbour of New York
is being fitted for use by the largest type of modern liner. The work on the Ambrose Channel is being steadily pressed forward. Two years ago, when it was first opened, its use was restricted to vessels of six hundred feet in length and a draught of twenty-nine feet as a maximum. Now it would seem that there is no restriction as to length, and a draught of thirty-seven feet is permissible at ordinary low tides. Though upwards of 42,000,000 cubic yards of spoil have been dredged from it the scheme is by no means yet complete, and by the time the work is finished the port of New York will be quite accessible at all states of the tide by any vessel as yet either built or seriously contemplated. Over £1,000,000 sterling has already been spent over the operations. In contrast to the way in which the United States National Exchequer is improving the channel into New York, regardless of cost, we have the Southampton Harbour Board complaining that further dredging of their channel would mean "considerable" cost, and find that an expenditure estimated at a mere £88,000 is apparently to them quite prohibitive under present conditions.

The Mersey Docks and Harbour Board
on the other hand is doing what lies in its power to increase the safety and convenience of their port. They are approving of a scheme whereby all their lighthouses and light vessels are to be fitted with Marconi installations which will thus put them in instant communication, by means of a central installation on the tower of their new offices, with the headquarters of their system, and thus enable assistance to be despatched with the utmost promptitude should occasion for it arise.

Fishguard
seems to win more decided confidence from the Cunard Company as greater experience of its advantages is attained. There has been made an announcement that after the turn of the year, at all events for the remainder of the winter season, east-bound Cunarders will cease to call at Queenstown and will proceed to Fishguard direct. This announcement has naturally excited keen apprehension in Queenstown, and the Irish members of Parliament have asked questions in the House of Commons on the subject. But they were naturally met with the reply that the Post Office Mail Contract only applies to west-bound voyages, and that the Postmaster General cannot under his contract interfere with the arrangements which the directors think fit to make in regard to their homeward steamers, and so, as far as may be seen, the arrangement stands. I should not be surprised if the Cunard Company make a strong endeavour a little later on to omit the Queenstown call on the outward voyage also, though they will no doubt find that much pressure will be brought to bear on them to prevent them from realizing their wishes. With twenty-five knot vessels in their service the use of Queenstown as a mail port is an absolute loss of time. Conditions have completely changed during the last fifty years, for the *Lusitania* is nearly twice as fast as the crack ship of the period when Queenstown was first accepted as a port of call.

CORRESPONDENCE.

We do not hold ourselves responsible for the opinions expressed by our correspondents.

A Curious Case of a Fractured Cylinder.

To the Editor of the MARINE ENGINEER AND NAVAL ARCHITECT.

SIR,—The fractured low-pressure cylinder illustrated in your issue of December, reminds one of the memorable breakdown of the *City of Paris* in 1890.

I believe that the cause was the same in both cases, *viz.*, the use of a large steel conical piston.

Such pistons are light and strong, but lack rigidity.

Should a little grit be carried into the cylinder by priming, the piston rings may seize on the down stroke, then the other two engines would tend to pull the rod through the piston, and by buckling the cone would exert enormous bursting pressure on the clymder; the action, in fact, would be similar to a toggle.

In the present case, the resistance of the cylinder pulled up the engines, but in the case of the *City of Paris* the cylinder split into huge fragments, which fell into the pit and fouled the crank, thereby causing the shafting to be torn up, and the engines completely wrecked. Yours faithfully,

FRED. HOVENDEN.

THE "LENTHALL" COURSE DELINEATOR.

ANY means which have for their object the simplifying of an operation or its performance in a better manner or in less time must always receive more or less appreciation from those who can profit by their use in proportion to their ability to apply such use to the best efficiency. There are few firms who have more consistently and continuously utilized their energies to this end than Messrs. Heath and Co., Ltd., of Crayford and London. They have been eminently successful in the past in providing such means in many directions, and they are now putting on the market an extremely simple device under the above title, which will meet a long-felt want, and which has such a feature of utility as to render it desirable that we should give a full description of it with illustrations.

This instrument is useful to all in charge of vessels, and particularly to yachtsmen, fishermen and masters of coasters and other small vessels, as with it all the problems in dead-reckoning navigation can be accurately solved without the use of books, tables or any other instruments.

The following are a few of the many problems that can be accurately solved with it :—

1. Finding the course to steer a vessel, in order to counteract the effect of a current and to keep her on her true course, and the speed she will make good on her true course.

2. Finding the course and distance made good by a ship after she has sailed various courses and distances.

3. Finding the distance the ship is off a lighthouse or other fixed object, from two bearings of the same, and the distance run between the times of taking the bearings, also the distance the ship will pass off the object when abeam if she keeps on the same course, also the course to steer in order to pass a given distance off the object.

4. To yachtsmen, fishermen and others who have not the facilities for having a chart spread out before them, it is particularly useful when making a crossing from one port to another. With it they can lay off, on a small sheet of paper, the course to the port they wish to sail to, and the position of any object they wish to sight, or any shoal or other obstruction they wish to avoid, and can then mark off each tack they make, and see at a glance how they are progressing towards their port of destination, and exactly how far they should stand on each tack. This can be done just as accurately as if they were working on the chart, and in a fraction of the time.

The instrument is made of transparent celluloid. It is radially divided from a central point *A* into points, half-points and quarter-points of the compass (see Fig. 1), or into degrees (see Fig. 2). A slit, just wide enough to take the point of a pencil, is cut from the central point *A* to a point near the outer edge of the instrument. The slit is marked with a scale divided into 10 equal parts, and each division is again sub-divided into 10 equal parts. The divisions on the scale are numbered consecutively from 1 to 10, commencing with the first division from the central point of the instrument. The radial lines indicating the points of the compass are numbered consecutively from 1 to 8 and 8 to 0 on either side of the slit (see Fig. 1). In the instrument divided into degrees, the radial lines indicating every 10 degrees are numbered consecutively in tens, from 10 to 90 and 90 to 0 on either side of the slit (see Fig. 2).

The problems can be worked out on plain paper, but it is much simpler and quicker to use paper that is ruled with parallel vertical lines. Special paper having the impression of a compass card, as shown in Fig. 3, is provided for the purpose, and greatly facilitates the operation.

The commencement of the slit is the central point of the instrument, from which all the radial lines radiate, therefore this point must always be placed

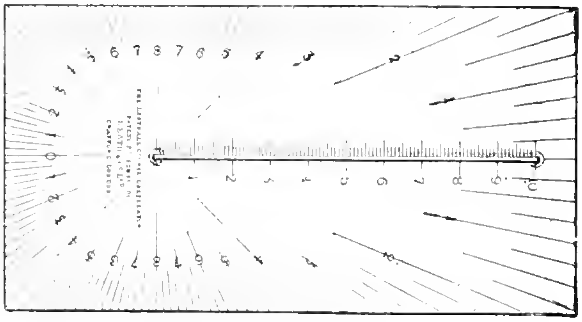


Fig. 1

over the spot from which the course or bearing has to be laid off.

In laying off a course on the paper ruled with parallel vertical lines, take all the vertical lines to represent North and South. Make a dot on one of them and place the instrument with its central point over dot, and, with the point of a pencil as an axis, turn the instrument to the left till the radial line on right of the slit numbered 2 lies over the vertical line

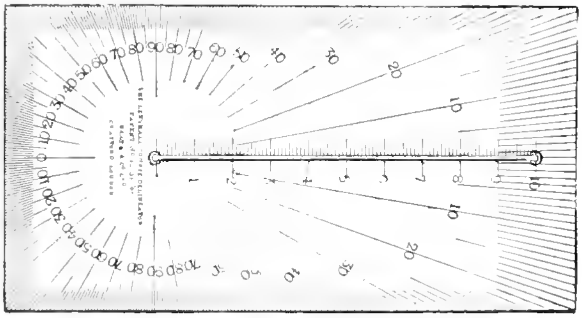


Fig. 2

with dot on it. The slit will now bear 2 points of the compass to the left of the vertical line, or N. N. W. and a line drawn with a pencil through the slit, or a dot made at any portion through the slit will bear N. N. W. from dot. Any distance can at the same time be marked off by the aid of the scale on the slit. To do this, each division on the scale must be taken to represent a certain distance, say 1 mile, 5 miles or 10 miles each, according to the problem to be worked out. The sub-divisions will of course represent one-tenth of that distance.

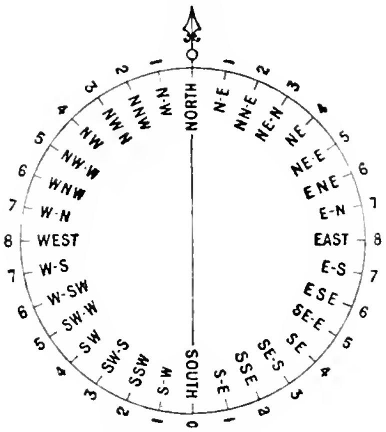
As an illustration we will take the case of a ship having sailed N. W. by W. 30 miles, N. E. by N. 60

miles, and N. W. 40 miles, it is required to know her course and distance made good.

The vertical lines on the paper represent North and South, and each division on the scale represents 10 miles.

As indicated in Fig. 4, on one of the vertical lines make a dot *a* to represent the point of departure, now place the instrument with its central point over dot *a*, and, with the pencil point as an axis, turn the instrument to the left till the radial line indicating 5 points of the compass on the right of the slit lies

Fig 3.



over the vertical line with dot *a* on it. The slit will now bear North 5 points West or N. W. by W. Through the slit at the third division on the scale (=30 miles) make a dot *b*, which will be 30 miles N. W. by W. of dot *a*, or the position of the ship at the end of her first course. Now place the instrument with its central point over dot *b* and turn it to the right till the slit bears N. E. by N. (North 3 points East) and through the slit of the 6th division on the

Fig. 4.

scale (=60 miles) make a dot *c*, which will be the position of the ship at the end of her second course.

To lay off the third course, place the instrument with the central point over dot *c* and turn to the left till the slit bears N. W. (North 4 points West), and through the slit at the fourth division on the scale make a dot *d*, which will be the position of the ship at the end of her third course.

To find the course and distance made good by the ship, place the instrument with its central point over dot *a* (her point of departure) and the slit over dot *d* (her present position), then the distance made good will be shown by the position on the scale that dot *d* appears at; in this case it is 9·7 divisions (9 divisions and 7 sub-divisions) = 97 miles, while the course is indicated by the radial line that lies over or nearest to the vertical line with dot *a* on it; in this case it is the radial line indicating 1 point on the right of the slit. The course is, therefore, 1 point to the left of North or N. by W.

Or take again the case of a vessel making 8 knots an hour through the water wishes to sail to a port N. N. W. of her position, and a current is running due East at 3 knots an hour, what course must the vessel steer in order to counteract the effect of the current and to make good her true course, and what speed per hour will she make good on her true course?

Take the division on the scale of the slit to represent 1 mile each in this case, which is illustrated in Fig. 5.

On one of the vertical lines make dot *a* to represent the position of the vessel, and place the instrument with its central point over dot *a* and turn the instrument till the slit bears N.N.W. (2 points to the left of the vertical line); then, with the pencil through the slit, draw a line a.b., which is the course the vessel wishes to make good.

With the central point still over dot *a* and the pencil point as an axis, turn the instrument to the right till the slit bears East (8 points to the right of North). At the third division on the scale (= 3 miles) make a dot *c*, which represents the drift of the current from dot *a* in one hour. Now place the instrument with its central point over dot *c* and turn it to the left till the slit cuts the course line a.b. at the eighth division on the scale of the slit (= 8 miles, the speed of the vessel through the water). On the line a.b. make a dot *d* through the slit at the eighth division on the scale. The course to steer will now be indicated by the radial line that lies over or nearest to the vertical line with dot *c* on it. In this case it is the radial line on the right of the slit indicating $3\frac{3}{4}$ points, the course to steer is, therefore, North $3\frac{3}{4}$ points West, or N. W. $\frac{1}{4}$ N., while the distance the vessel will make good per hour is the distance *a. d.*, which can be measured by the scale. In this case it measures 6·4 divisions $= 6\frac{4}{10}$ miles.

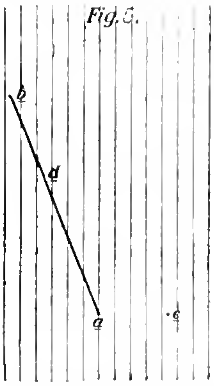
Or again say that a ship sights a lighthouse and finds that it bears 2 points of the compass to the left of her course. After sailing three miles on the same course she again takes its bearing and finds it bears 5 points to the left of her course.

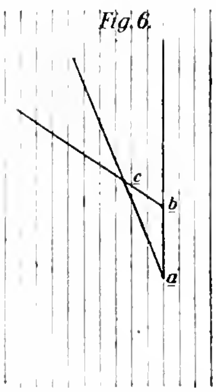
How far is she off the light at the time of taking the second bearing, and how far will she pass off it when abeam if she keeps on the same course?

Take the divisions on the scale to represent 1 mile each and then, as shown in Fig. 6, lay the instrument on the paper and with a pencil through the slit draw a line to represent the course of the ship. Through the central point of the instrument make a dot *a* to represent the position of the ship at the time of taking the first bearing, and through the slit at the third division on the scale (= 3 miles), make a dot *b* to represent her position at the time of taking the second bearing. With the central point still over dot *a* and the pencil point as an axis, turn the instrument to the left till the radial line indicating two points of the compass is over the course line; through the slit draw a line. Now

place the instrument with its central point over dot *b* and turn it to the left till the radial line indicating five points is over the course line; again draw a line through the slit.

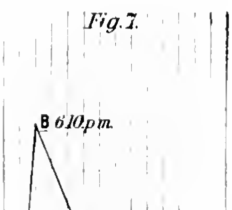
The lighthouse is situated somewhere on each of these two lines, and must, therefore, be at the point where they cross one another. At this point make a dot *c* to represent the position of the lighthouse. From *b* to *c* measures 2·1 divisions on the scale, therefore the ship is $2\frac{1}{10}$ miles off the light at the time of taking the second bearing. To find the distance she will pass off it when abeam, place the





instrument with the radial line marked 8 lying over the course line and dot *c* appearing in the slit. The position on the scale at which dot *c* appears will give the distance, in this case it is the 1·75 division $= 1\frac{3}{4}$ miles.

Or again, as illustrated in Fig. 7, a yachtsman intends making a crossing from Port A to Port B, and before leaving he studies the chart and makes a



note of the following particulars:—The compass course from A to B is N.N.W., the distance is 45 miles, there is plenty of water all the way, a lightship is situated 20 miles N. by W. from Port A, and, lastly, the tide runs N. by E. at an average speed of two knots an hour for the first five hours, then S. by W. for seven hours, and then N. by E. again.

Taking the divisions on the scale of the instrument as five miles each, he makes a dot **A** on the paper, and with the central point of the instrument over dot **A** and the slit bearing N.N.W. he makes a dot **B** at the ninth division of the scale (= 45 miles) and connects the two by a straight line. He then turns the instrument till it bears N. by W., and at the fourth division of the scale (= 20 miles) makes a dot **L**. Dot **A** represents Port A, dot B represents Port B, the line connecting the two is the direct-course line, and dot **L** is the position of the lightship. He has now finished with his chart, and has a small plan of all that is required to take its place.

He weighs anchor at 6 a.m. and finds he can fetch North and is going at 5 miles an hour through the water. He keeps on this course for three hours, and at 9 a.m. decides to go about. Before doing so he marks off from **A** his course and distance sailed, North 15 miles, and from that point marks off the drift of the tide for three hours, N. by E. 6 miles. At this point he puts the time of going about, 9 a.m. He now goes about and finds he can fetch West and is still making about 5 miles an hour through the water. He passes the lightship abeam on his port hand at 10 a.m., distance off 1 to 2 miles, and on referring to his plan finds this to about agree with his calculations. He also notes that if he sails about 19 miles on this tack and the wind remains true he will be able to fetch his port on the next tack.

At 1 p.m. he goes about again and marks off his run from his 9 a.m. position, West 20 miles. The drift of the tide is nothing, as it has run for two hours each way. On his plan at his present position he puts the time 1 p.m., and with the instrument finds Port B to bear about N. $\frac{1}{2}$ E., distance 21 miles. On this course, and with the tide under his lee bow, he is able to give his boat a good full, and finds he is going nearly 6 knots an hour through the water, but as the tide is now almost dead against him he reckons he is only making good about 4 knots an hour. At 5.45 he sights Port B almost right ahead, and arrives there at 6.10 p.m. He now puts the names of the two ports and the date on the plan, and it is a correct record of his day's cruise. It gives for future reference each tack made and the times of going about and the drift of the tide, and if any miscalculations have been made it shows what the errors were. These plans can be filed and kept, and are not only interesting, but very handy for future reference.

GOOD progress is being made with the building of Mr. E. H. Hunter's 74-ton auxiliary ketch, at the Osaka Ironworks, Japan. The yacht, which is to Mr. James A. Smith's design, is being built of steel, under Lloyd's special survey, and is to be classed 100 A1. The 80 h.p. auxiliary machinery has been tested and shipped, also most of the equipment, which is entirely by English makers, and includes an 18 ft. motor launch by Mr. J. A. Smith, range and stoves, baths, deck gear, etc.

HOLLAND-AMERICA LINER "NIEUW AMSTERDAM."—This large passenger steamer has been in the hands of the builders, Messrs. Harland & Wolff, Ltd., Belfast, for the past few weeks, for certain alterations necessitated by the popularity of the vessel in the Holland-America line. The bridge front on the awning deck has been extended, largely increasing the first-class dining saloon, etc. The saloon is a magnificent apartment extending the whole width of the ship, and the addition of over 150 seats now added will make it one of the largest and finest crossing the Atlantic. The alterations also provide extra promenading space on the bridge deck, for games, etc. The necessary work having been carried out with the greatest despatch, the vessel left Belfast on the 20th Dec. for Rotterdam, where in due course she will resume her sailings in the New York trade. The *Nieuw Amsterdam* is a vessel of over 17,000 tons, and was built by Messrs. Harland & Wolff, Ltd., at Belfast, in 1906. She is the second largest of the Holland-America fleet, the majority of which have been built by Messrs. Harland & Wolff, who constructed the *Rotterdam*—23,980 tons—for that Company last year.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondent*).

Portsmouth Dockyard.

The first keel plate of our new battleship, the *Orion*, was laid on November 29th, by Mrs. Tate, the wife of the admiral-superintendent. The ceremony was very short and of a somewhat private nature. There were present Rear-Admiral Sir John Jellicoe, the Controller of the Navy; Rear-Admiral Tate, the admiral-superintendent; Captain Fawckner, the captain of the yard; Mr. John Apsey, the manager of the Constructive Department; and a few others. The keel plate was lowered on the blocks, and Mrs. Tate having tapped the four corners the brief ceremony concluded. The *Orion* is being built on the same slip as the *Neptune* occupied. Strict secrecy is being observed as to all that relates to the vessel, but it is understood that she will be about 550 feet long, with a beam of 88½ feet. Her displacement will be 22,500 tons, and the indicated horse power 27,000. The machinery will, of course, be on the turbine principle, and she will have eighteen water-tube boilers. The vessel will carry ten 12-inch guns, which are to be longer and more powerful than the present guns of that calibre, and they will be mounted in barbettes, so placed as to give a broadside fire of ten guns, with six firing ahead and eight astern. She is only to have one mast, a tripod. The battleship *St. Vincent* commenced her steam trials on December 6th, after which she carried out her circle and torpedo trials. She was to go out again for her gunnery trials on December 23rd. The battleship *Neptune*, which was launched in September, is making very good progress. All her side armour has been got in position, as has also a large quantity of her propelling machinery, and her water-tube boilers are being taken on board. The battleship *Prince George* has completed her refit and carried out her steam trials. She is to be commissioned on December 29th for service in the local Sub-Division of the Home Fleet. It does not appear as if the Admiralty are going to carry out any more experiments with the harbour defence boom, at any rate with the destroyer *Ferret*, which cut through it so easily a few months ago. The vessel has been sent round to the Nore, where it is understood she is to act as a target for gunnery trials, the details of which are being kept secret. The division of submarines, which is to be permanently stationed at Dundee, left here on November 27th and arrived at the northern port fifty-six hours later, having covered a distance of 512 miles in that time, which must be considered a record performance for that class of craft. The flotilla consisted of ten submarines of the "C" class, and was escorted by the parent ship *Vulcan*, the scout *Forward* and the destroyer *Wizard*. The average speed was 9·8 knots. It was intended to have made a non-stop run, but "C 28" broke down and there was a delay of an hour-and-a-half while the artisans of the *Vulcan* put her right. The flotilla was joined off Yarmouth by "C 10," the third submarine to be built in a public yard. The cruiser *Terrible*, having been detailed to take out to Colombo a new crew for the *Powerful*, the flagship on the Australian station, left on November 30th for Devonport to embark ratings, but returned almost immediately with engine defects. Having been put right she proceeded to Devonport on December 6th, subsequently leaving there for her destination, with the destroyer *Bittern* under convoy to Gibraltar. His Majesty's yacht *Alexandra*, which was used by the King of Portugal on His Majesty's visit to this country, has been taken into dock for her annual refit, as has also the *Victoria and Albert*. Both yachts are to be completed by February 16th, but there are no heavy jobs to be done, redecorating being the chief thing. The announcement that Admiral Lord Charles Beresford was to be the Unionist candidate for Portsmouth came as a surprise, and his welcome to the town was most remarkable. There were about ten thousand people at the station. Bluejackets took the horses out of the carriage that was awaiting him, and the admiral was drawn in triumph through the cheering crowds to Southsea, where he was staying.

Devonport Dockyard.

The same day that the *Orion* was officially commenced at Portsmouth a similar ceremony took place here with the cruiser *Lion*. The ceremony was witnessed by only a small party, including Rear-Admiral Cross, the admiral superintendent, and the duty of laying the keel plate was entrusted to his wife. Mrs. Cross having turned an electric switch, the same one used by the King in laying the keel of the *King Edward VII.*, machinery on the floor of the slip was set in motion, and this drew the keel plate on to the blocks. Then, using a pneumatic riveter, which was afterwards stamped with her initials, Mrs. Cross, drove in the first rivet. Others present also drove in rivets. The new cruiser will be about 700 feet long—100 feet longer than the *Indefatigable*—while her horse power will be 70,000, as compared with the *Indefatigable's* 45,000. Her armament and armour will be improved and she will without doubt be the most formidable vessel of her type in existence, at any rate for the present. To permit of the construction of the *Lion* the slip at the Mutton Cove end of the South Yard, which was 520 feet long when completed five years ago, and has since been lengthened, is being again extended about 100 feet. At the time of writing the work is not quite completed. The foundations for the extension were laid at the time the slip was constructed, so that the extension which is being carried out is all above the surface. No attempt is being made at record breaking, but the progress of the new vessel is very satisfactory. In the adjacent shops a large amount of work has been done in connection with the preparation of the plating and other portions necessary for ensuring steady progress. Work in connection with the arming of the battleship *Collingwood* is nearing the final stage and she is to commence her steam and gun trials immediately after Christmas. The vessel is to be ready for commissioning by the end of the current financial year, March 31st. The destroyer *Bittern* left on December 7th under convoy of the *Terrible*, for Gibraltar, where she is to go into dockyard hands for a refit. An examination of the underwater fittings of the destroyer *Mermaid* has revealed defects in the propellers, several portions having been broken off, apparently by coming into contact with sunken wreckage. While she is in dock her gun sight fittings will be tested. It is officially announced that Rear-Admiral Galloway is to relieve Rear-Admiral Burney in command of the local Sub-Division of the Home Fleet on January 4th. Admiral Galloway was promoted to flag rank two years ago, at which time he was commodore of the Portsmouth Depot.

Chatham Dockyard.

It is very satisfactory to know that there are to be no discharges during the winter. Mr. Lamb and Alderman Jenkins, the Members of Parliament for Rochester and Chatham respectively, recently had an interview with the First Lord with reference to the prospects of the yard, and Mr. McKenna informed them that there would be no reduction in the number of hands, as it was intended to keep up the repair programme. The battleship *London* has carried out her steam trials, after a thorough repair of her machinery, with excellent results, and she is to be commissioned for service in the Atlantic Fleet on January 22nd. The *London* has been in dockyard hands for several months, her refit having cost about £70,000, and she is now nearly as good as when she was first commissioned. The refits of the battleship *Lord Nelson* and the cruiser *Dido* have also been completed, and they have both rejoined the First Division of the Home Fleet at Portland. The cruiser *Apollo*, which had been detained for the past three months to assist in fitting out the cruiser *Naiad* for service as a mine layer has also left. She has gone to Devonport to take up duty as a mine layer in the Devonport Sub-Division of the Home Fleet. Work will shortly be commenced on the cruiser *Euryalus*, which has come round from Portsmouth to be refitted at a cost of £51,000. The battleship *Prince of Wales*, flagship of Vice-Admiral Prince Louis of Battenberg, Commander-in-Chief of the Atlantic Fleet, has come in for a refit, which it was at first thought would be carried out at Gibraltar. Submarine "C 20" was launched on November 27th, the ceremony being performed by Lady Drury, who was accompanied by Admiral Sir Charles Drury, the Commander-in-Chief at the Nore, Rear-Admiral Ommaney, the admiral-superintendent, and the principal officers of the yard were also present. A brief religious service was conducted by the Rev. F. Sims, the

chaplain of the yard. As an outcome of the lectures delivered to the engine-fitters employed in the yard last winter it has been decided to form an engineering association, with the object of extending the scientific and technical knowledge of the members, and lectures are to be given fortnightly during the winter and monthly during the summer months. It is also hoped to establish a benevolent fund. The admiral-superintendent has accepted the post of president and Engineer Rear-Admiral Rudd is the vice-president.

Sheerness Dockyard.

As anticipated, one of the new large floating docks is to be sent here, and orders have been issued for the dockyard staff to put down moorings in the Medway. The ships of the Atlantic Fleet belonging to the port have come in to give Christmas leave. The battleship *Implacable* had already given leave to her crew previous to going to Gibraltar, where she is to undergo her annual refit. The second group of special service vessels of the Nore Home Fleet has been strengthened by the battleship *Canopus*, which paid off at Portsmouth on her return from the Mediterranean and went on to Chatham to re-commission with a reduced nucleus crew. The battleship *Ocean* is also to return home from the Mediterranean and join the group. The cruiser *Brilliant* has paid us an unexpected visit. She has been stationed at Newfoundland during the summer on fishery duties, and came home to pay off and recommission, after which she returned to her station. The *Brilliant* was built here eighteen years ago, and at that time was the largest and most powerful vessel laid down at this yard. The destroyers *Tartar* and *Ure* have completed their refits and have gone to Harwich to resume duty with the First Destroyer Flotilla, and the *Dee* and *Swale* have been taken in hand. The *Dee* is in future to be attached to the Second Flotilla, in which she will commence her duties early in the New Year. The *Rother* and *Waveney*, both of the First Flotilla, are also to be refitted. The *Cherwell* and *Mohawk* are almost ready for sea, but they will probably remain in the Medway until the Flotilla has finished Christmas leave, which will be about January 8th. The new ocean-going destroyers *Afridi* and *Maori* will also remain in the Medway until that time. Work on the bows of the *Saracen*, which was suspended while the material was being prepared, is progressing, and the vessel will be ready to take part in the first cruise of the New Year. The torpedo-gunboat *Dryad* has returned to Portsmouth to resume her duties as navigational school ship. She has been fitted with water-tube boilers and has had five new cabins constructed to provide improved accommodation for the navigation classes. The refit of the torpedo-gunboat *Hazard*, one of the sea-going depot-ships for submarines, is shortly to be proceeded with. She is to have a thorough overhaul and repair, in addition to being fitted with two new water-tube boilers. Torpedo Boat No. O66, of the Nore Flotilla, stranded on the West Barrow Sands during the gale on December 3rd, and strained her propeller shaft, and she has had to be dry-docked. On November 26th, in the presence of Rear-Admiral Johnston Stewart, the admiral-superintendent (who was succeeded by Captain Torlesse on December 15th), and a large number of naval officers, Engineer Rear-Admiral Priston unveiled in the dockyard church a memorial tablet to Engineer-Captain Edwards, who died suddenly on board the battleship *Agamemnon*, at Invergordon, in Ocober, 1908. The tablet was erected by his brother officers.

Pembroke Dockyard.

The cruiser *Blanche* was launched on November 25th and named by Lady Philipps, wife of Sir Owen Philipps, M.P. After the launch the Captain-Superintendent and Mrs. Mundy gave an "At Home" at the Moula Loft. The *Blanche*, which has been built under the supervision of Mr. A. Nicholls, assistant constructor, is of the same class as the *Boadicea* and *Bellona*, but she will differ from the latter vessel, as she is only to have one mast. Her cost, exclusive of armament, is estimated at £285,500, and her dimensions are:—Length between perpendiculars, 385 feet; breadth, 41 feet 6 inches; draught, 13 feet forward and 14 feet aft; displacement; 3,380 tons. She will be fitted with turbine machinery, and 18,000 indicated horse power will give her a speed of 25 knots. Her armament is to consist of two 4-inch guns on the forecastle and eight 4-inch guns on the upper deck, and she will carry a complement of 292 officers and men. As a memento Lady Philipps was presented with a carved oak box, inset in the lid being a picture of the vessel as she will appear when completed. The *Blanche* had been 228 days in hand when she left the slip. The slip was not long disengaged, for on December 6th the cruiser *Blonde* was formally laid down by Mrs. Mundy. The small company present included, in addition to the principal officers of the yard, Sir Owen and Lady Philipps and Sir Owen and Lady Scourfield. Mrs. Mundy afterwards drove the first rivet by means of a pneumatic hammer, other ladies and gentlemen following suit. The *Blonde* will be an exact replica of the *Blanche*, and an effort is to be made to launch her within six months, which will be about six weeks earlier than the *Blanche*. The cruiser *Bellona* is now carrying out her acceptance trials, which are to be completed by New Year's Day. She will, it is understood, be commissioned on January 13th. The refit of the destroyer *Osprey* has been completed, and the *Sylvia* has come round from Devonport. The latter vessel was paid off and her crew commissioned the *Osprey*. It is understood that the destroyers *Daring* and *Hardy* will shortly be sent here to undergo refits and to have their boilers re-tubed. There will also be some other small work here, as in future four torpedo boats are to be permanently based at Pembroke Dock, and that will be sure to give us a few small jobs.

THE INSTITUTION OF CIVIL ENGINEERS—STUDENTS' MEETINGS.—At the Students' Meeting, held at the Institution on 17th December, Mr. J. M. Dobson, M.Inst. C.E., in the chair, a paper was read by Mr. H. T. Tudsbery, Stud. Inst. C.E., on "The Foundation and Construction of Dock Walls; with special reference to the recent work at Southampton." The author, having discussed the conditions governing the design and construction of dock undertakings, dealt with the survey and preliminary works. In the second part of the paper, the construction of walls built in the dry, concrete-block walls and pier, and arch walls, was described. The concluding portion of the paper was concerned with cement and concrete. The paper was followed by an interesting discussion in which the following students took part: Messrs. A. J. Hart, E. Timothy, G. F. Walton, N. Smith, R. A. Inglis, M. W. Pretyman, R. J. Samuel and P. G. Bowie.

NEW TWIN-SCREW FERRY STEAMERS FOR CALCUTTA.—Messrs. John I. Thornycroft & Co., Ltd., have recently shipped from their Woolston Works at Southampton, four twin-screw ferry steamers for the Port Commissioners of Calcutta for their passenger service. About three years ago Messrs. Thornycroft delivered seven ferry steamers to the Port Commissioners for a new passenger service which they were inaugurating. These boats have proved so successful that Messrs. Thornycroft were given a further order for the four boats which are now being shipped. They have been erected at Woolston Works, properly marked for re-erection, and are being shipped by the Peninsular & Oriental Company's s.s. *Pera*. The following are the leading particulars of these boats, dimensions, etc.:—Length overall, 105 ft.; length B.P., 100 ft.; breadth moulded, 20 ft.; depth moulded, 10 ft.; draught (loaded), 5 ft.; speed, 12 knots; I.H.P., 500. The vessels are built of steel to Lloyd's A1 (river class) and Board of Trade requirements for special passenger certificate. Special attention has been given to the sub-division of the hull, there being no fewer than seven complete water tight bulkheads. There are two stout wood fender belts, one extending all round the vessel near the deck, and one from the forward to aft bulkheads near the waterline. The machinery is placed amidships, and the arrangement of hull provides for four cabins for passengers, two forward and two aft, each with a roomy stairway and companion. Nominally the vessel is to carry two hundred passengers, but there is room for a considerably larger number. The machinery consists of two sets of tri-compound surface condensing engines, and a marine type boiler of extra large size to deal with the rather poor quality native coal, working with natural draught, or when required with forced draught on the closed stokehold system. The cylinders are 9 in., 13 in. and 20½ in. diameter, with a stroke of 11 in., working at about 300 revolutions per minute. The boiler is 11 ft. 6 in. diameter and 10 ft. 3 in. long, with a heating surface of 1267 sq. ft., and a grate area of 42 sq. ft. with a working pressure of 180 lbs. The boiler and machinery are in separate water-tight compartments.

TWO-CYCLE MARINE OIL ENGINE.

WE recently had the opportunity of a trip upon a vessel named *Bolinders VII.*, which is fitted with an oil engine, and has been brought over to this country from Sweden to demonstrate the advantages of this system of oil engine installed for marine purposes.

The *Bolinders VII.* is a bluff-built fishing vessel of the Swedish type, 60 ft. × 19 ft. × 9 ft., fitted with a direct reversible engine of 80 B.H.P., burning crude oil, shale oil or paraffin, and capable of doing 8 knots per hour.

The design of the engine is eminently simple, as can be seen from fig. 1. It has no cam valve gears, merely two eccentrics to each cylinder, and a valve motion not much more complex than the ordinary link-motion and certainly less so than any of the variations of the Corliss gear. We understand that the consumption of heavy oils is less per B.H.P. per hour than that of any other marine motor on the same thermodynamical principle in actual commercial use.

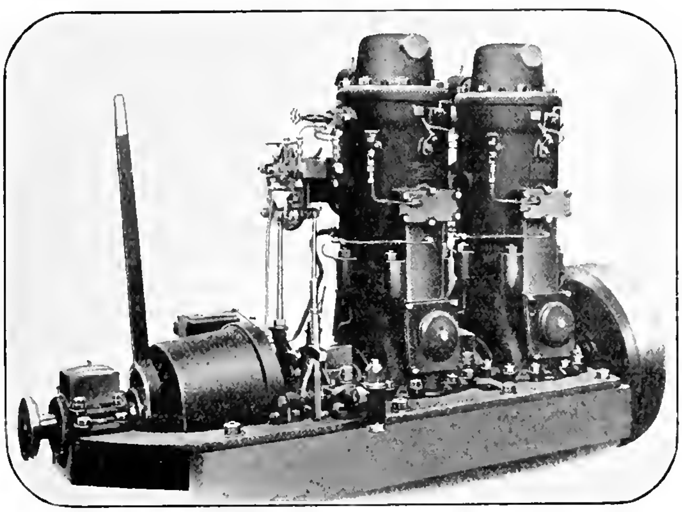


Fig. 1.

There is no delicate magneto-ignition with its timing devices, dynamo, auxiliary batteries, etc., for the vaporiser serves a double purpose. A bulb at the top of the cylinders is heated up by a blow lamp for ten to fifteen minutes at the start. The fuel is pumped into this just before the end of the up-stroke, and is immediately vaporised and fired. The heat evolved by the compressions and explosions which follow is quite sufficient to keep the temperature within the bulb at flash point.

The *Bolinders'* motor runs on the two cycle principle, and cleanses the cylinder and ignition bulb (*i.e.*, vaporiser) with a quantity of air which the piston sweeps before it.

The few working parts are not exposed to dirt or weather, but are securely boxed in. The lubrication is automatic, and each important bearing has its own pump and pipe. The only parts which might be considered liable to wear are the piston rings, but, since in some cases, they have been continuously running for two years without renewal, heavy repair costs in this part of the mechanism need not be dreaded. A special alloy is used for the rings, and the cylinders are ground absolutely true after boring, which probably accounts for the excellent results obtained.

The engine can be caused to drive the vessel ahead or astern at will without the interposition of either epicyclic clutches or feathering propellers. That is to say, it is one of the few Oil Motors which has the slightest hope of being employed on the highly-powered commercial vessels of the immediate future.

Reversible Petrol Engines for marine service are not uncommon in the United States, while reversal by compressed air has been the fairly usual practice in motors of various designs for some time past on the Continent of Europe, but the *Bolinders* is most unquestionably the first to reverse its direction of rotation without appealing to any external source of power.

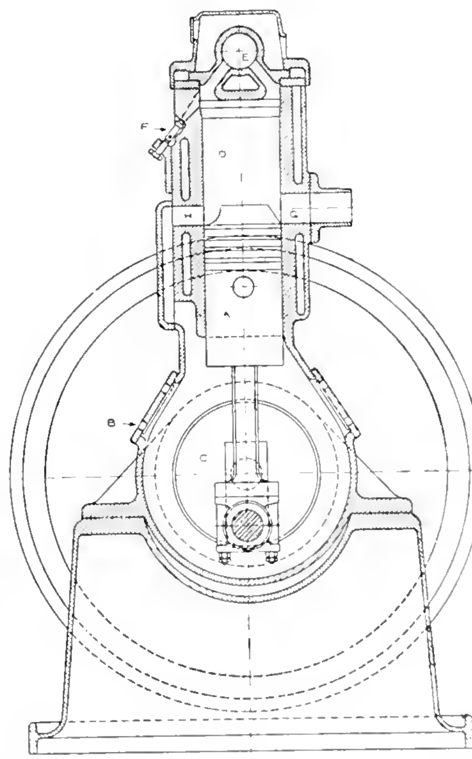


Fig. 2.

In one of the best known commercial marine motors a belt driven compressor is installed. In another a two-stage air compressor is mounted on the crank shaft. In the *Bolinders* no special fitting is required except a plain receiver which is connected to the engine cylinders, a portion of the exhaust gases escaping into it until a sufficient pressure is attained.

The speed of the engine can be regulated by the governor, down to "Slow ahead." For any lower speed it is best momentarily to throw into gear the friction clutch which is provided for stopping and starting and to facilitate reversal.

In order that the working of the engine can be clearly understood we give in Fig. 2 a sectional view, which, as far as its details are concerned, speaks for itself.

On the up stroke of the piston (A) a partial vacuum is created in the enclosed crank case (C), causing the necessary charge of air to rush in at the two opposite inlets (B).

Near the end of the stroke, an oil-pump automatically injects the proper amount of oil through the nozzle (F) into the igniter ball (E). This latter has been previously heated to a dull red heat by a blow-lamp, as before explained, so that the hot walls of same immediately convert the oil into vapour. The mixture of air and oil gas is then automatically fired driving the piston downward during which the charge of air previously drawn into the crank case is compressed and when the piston approaches the end of the down stroke, it uncovers the exhaust port (G), permitting the burnt charge to escape through the silencer, until its pressure reaches that of the atmosphere. Directly afterwards the transfer port (H) on the opposite side of the cylinder is uncovered by the piston, thereby allowing the charge of air compressed in the crank chamber to rush into the cylinder, where it is deflected upwards by the shape of the top of the piston and caused to fill the cylinder, thereby expelling the remainder of the burnt charge.

The works of Messrs. J. & C. G. Bolinders, Ltd., of Stockholm, cover in all 200 acres, the motor, fitting and machine shop having a floor area of over two acres. We understand that there are 4,000 Bolinders' Motors in daily use, mostly on the Continent, and the output for the last twelve months consists of 1,200 engines of various sizes. This latter figure can be increased by 50 per cent without crowding, so that Bolinders' Motor Works have probably a capacity greater than that of any other shop in the world for this class of motor.

The *Bolinders VII.* is on a tour round the British Isles and will be calling in at the majority of the ports of importance on the Coast. We gave an illustration and description of this vessel in our May issue.

Messrs. James Pollock Sons & Co. Ltd., of 3, Lloyd's Avenue, London, Marine Engineers and Naval Architects are the sole British representatives for these engines.

ROCKET LIFE-SAVING APPARATUS.

On December 10th, we were present at a demonstration of Rocket Life-Saving Apparatus, which is being manufactured and sold by Messrs. C. T. Brock & Co., of Sutton, near London. Mr. Schermuly is the inventor of the apparatus, and the tests were carried out by him on the Training Ship *Warspite*, moored off Greenhithe.

Mr. Schermuly very quickly had his apparatus ready and proceeded to fire a light rocket of about 2 lbs., but with a strong breeze blowing off shore this did not carry far enough, but directly a 6-lb. rocket was fired communication was easily established with the shore, and the line was seized by a number of *Warspite* boys who had been stationed there to act the part of rescuers. To this light line a rope was attached and hauled across, and finally a hawser. To the hawser was fixed a travelling breeches buoy, and in this a dummy was suspended and quickly hauled across the intervening space from ship to shore. Thus was demonstrated how a vessel, if provided with this apparatus, would be able to effect communication with the shore, and by which the crew and others could be saved in the case of a vessel in distress.

The apparatus is especially designed to be carried on board ship and may be taken aloft by one man, leaving both hands quite free for his ascent of the rigging. It may be suspended from any rope or spar, or fixed in position at any convenient place, and the rocket turned in the direction towards which it may be desired to fire. In evidence of this simplicity of construction and portability, it may be here mentioned that throughout the demonstration Mr. Schermuly manipulated his apparatus single-handed and took it into the rigging of the *Warspite* and fired a rocket.

In view of the sacrifice of human lives which often occurs off the coasts, we trust that ere long the Board of Trade will make it compulsory that ships are equipped with their own portable rocket life-saving apparatus, in order that the crew may be able to communicate with the shore when necessary.

It will be at once evident that another use to which the apparatus may be put is to effect communication between ships at sea, a line could quickly be thrown across a ship in distress and hawser passed for salvage purposes, which would be a very difficult matter without the rocket apparatus in a heavy sea, and more certain than boats, which might not be able to reach the distressed ship. We learn that sets have been purchased by the Admiralty for purposes of coaling at sea and that the Australian Government have also purchased sets.

TUNNEL BEARINGS AND THRUST BLOCKS.

Some Practical Repair Hints.

WHILE in a majority of cases the engine-rooms of steamships, even of the smallest sizes designed for coasting trade, are adequately equipped with modern designs of different machinery, it cannot be said that, speaking generally, the same amount of care is given to the proper arrangement of the very important parts of the machinery found in the shaft tunnel. This is all the more surprising because not only is the total horsepower of the machinery transmitted to one, or at most two shafts on ordinary boats, and therefore every care should be taken to avoid the risk of breakdown in such an important part of the mechanical equipment of the vessel, but also owing to the fact that the plant in the tunnel is not under such immediate supervision as that in the engine-room, it is quite possible that a suddenly developing fault may grow to serious dimensions before it is recognized by the engineer on watch at the time. For this reason, it may not be out of place to draw attention to one or two points with regard to tunnel bearings and thrust blocks, which from the result of experience in this direction appear to require a further amount of investigation.

It will be found by anyone interested in the subject that in the tunnels of most tramp steamers the water service pipes for the tunnel bearings are placed above the bearings without being connected up to them in any way. The result is that if such a bearing begins to run hot and the water is turned on, it runs all over the bearing and not only makes a disagreeable and dirty mess in the tunnel, but has a habit of rusting the shaft. Now it is apparent that as these bearings are nearly all hollow in the bottom half, it is not a hard job to drill two holes in the bearing, one to provide an inlet for the water and the other in order to drain it away. Where a boat has been originally fitted with the "pour on" type of water service pipe it is easy to modify the arrangement into a circulating system round the lower half of the bearing by screwing a piece of brass tube into the inlet hole of the bearing and to connect it up to the water service pipe with a piece of rubber tube. Another piece of brass tube with a rubber pipe attached should then be put on to the exhaust outlet of the bearing and the rubber pipe should be allowed to hang down on to the tank top The water will then drain into the after well and by the means shown in the sketch, Fig. 1, the water can be kept circulating under the shaft all the time and the bearing can thus be always kept cool In addition to this there is the great advantage that there will be no wet or rust about the outside of the shaft.

Another interesting point in this connection is the design of thrust shafts. The opinion may be expressed that, generally speaking, these are not designed with a sufficient margin of strength; it would be imagined that most engineers would know sufficiently about the requirements as regards strength and lubrication, and that the designers would be called upon to see that these conditions were adequately fulfilled, but in a very large proportion of steamers afloat at the present time it will be found that there is a continuous flow of sea water through the thrust blocks in order to keep them cool. The effect of this water on the shaft itself in corrosion is obvious, and this process must be continuous, as in most instances the water cannot with any degree of safety be shut off while the shaft is running. This is aggravated by the fact that owing to neglect of details in design sharp corners are left at the junction of the thrust collars with the main body of the shaft, aud at this weakest part, mechanically speaking, the effect of corrosion will be felt the soonest. The thrust shaft is generally of the same diameter as the tail end and the crank shafts, but the tail end shaft is protected from corrosion by one or more brass liners, excepting at the part that stands out into the water near the tapering This unprotected part of the tail end shaft in itself gives an indication of the damage which is simultaneously proceeding on the thrust which is flooded with sea water. The grooving that proceeds on the tail end shaft near the propeller is too well known to require much emphasis in view of the large number of propellers which are lost every year due to such grooving, and the same effect of sea water must be proceeding in a less degree in the thrust block. When one also considers the fact that there must be galvanic action constantly proceeding in the thrust owing to the mild steel collars being in intimate contact with their white metal bearings in the presence of sea water, it is apparent that the weakening takes place in the worst part possible, *viz.*, the outside fibres of the shaft, and such shafts are by no means strong enough to withstand continuous sea-going wear and tear, even if, according to the theory of design, they meet all conditions when they pass out from the shops.

A certain proportion of the failures of thrust shafts may be traced to the way in which the work involved in the design is carried out in the shops. In one instance where such a shaft broke under heavy stress, the fracture showed, somewhat indistinctly, but nevertheless sufficiently well, that the forging was a bad one, inasmuch as the outline of scrap could be seen in the centre of the fracture. This indicated that either the shaft had been forged under a light quick steam hammer, or else that the metal had been too cold, and it is worth remembering that such shafts should be forged under a heavy hammer which gives ponderous blows which can be felt throughout the entire mass of the material Moreover, these blows should not be delivered too quickly, as when the metal is in a ductile state, it should be given an opportunity to flow or set itself at the centre before it has been too much distorted by constant blows on the outside.

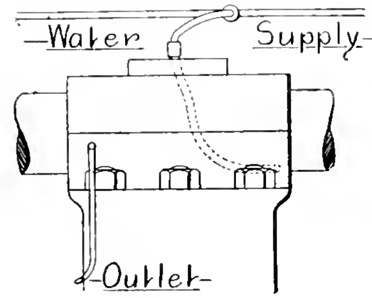


Fig 1.

Moreover, the material should be heated to very nearly its plastic heat before being worked and the correct forging heat is indicated to the men who understand their work by the material giving out a shower of white hot sparks when it is drawn out of the furnace; these are entirely different from the appearance of the sparks when the material is being burnt.

Yet another detail which would materially assist the life of thrust shafts and bearings, would be greater attention to the following point which, although it is only apparently a small detail, nevertheless causes a considerable amount of trouble if not attended to. The design of many of the thrust shafts in some boats is bad, inasmuch as the bottom of the collars on the shaft are finished to form a right angle and it is evident that this sharp angle is sufficient to form the beginning of a line of cleavage between the collar and the shaft, which must under exceptional conditions, such as the racing of a propeller, cause a very considerable amount of trouble Care should always be taken to place fillets, however small, at this angular junction as these would add wonderfully to the strength of the shaft The thrust block should also have a radius to suit the fillets on the collar, and this radius would therefore be considerably larger than those usually given.

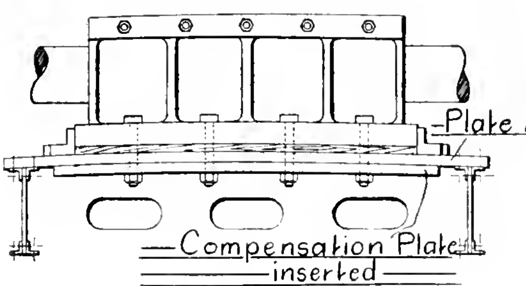


Fig. 2.

In order to show how these considerations actually affect the working of thrust blocks it may be interesting to relate two actual experiences which occurred in sea-going practice The first trouble was due to the fact that sea water was continually standing upon the plate A in Fig 2 about the thrust block and this corroded the plate The thrust itself was noticed to be working loose when the engines were racing, and it therefore became necessary to stop the engines and to put a compensating plate underneath the corroded one in order to strengthen it as shown in the sketch. This plate was fortunately on board among the cargo, but the fixing of this one inch thick steel plate into position in a rolling sea, and with the limited means available

on board ship was a very long and heavy business which took two days to accomplish. Had the working of the thrust not been noticed and corrected, however, it might have been entirely uprooted, and a complete breakdown to the engines would thereby have been caused. In order to prevent such plates from corrosion they require constant chipping and painting, and a very good plan in order to prevent the effects of the continuous splashing about of the cooling sea water through the thrust block is to place a layer of cement upon the floor all round the thrust block The important bearing of this accident upon the question of ample design of thrust blocks is, however, obvious.

Another accident might have been much more serious, if by good fortune the engineer had not been standing near the throttle valve when it occurred. This was the fracture of a 10-inch diameter thrust shaft during very heavy weather, at the section of the shaft where one of the collars was joined to the shaft proper as shown in Fig 3. As soon as it occurred the engineer stopped the engines, and the repair indicated in the sketch took two days and nights to finish. The first thing done was to lift the keeps on the tunnel bearings, and to put pieces

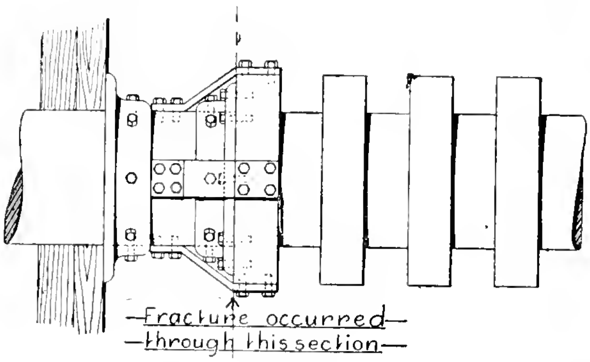


Fig 3.

of plate with coarse emery cloth wrapt round them under the caps. These were then tightened down, and this device kept the shaft from turning while the engineers were busy. The next step was to uncouple the thrust shaft and lift it, and then the thrust block was moved aft one space between the collars on the shaft, so that the forward collar where the fracture occurred was left projecting out of the thrust block. It was fortunate that in making this replacement, it was found that the only thing which had to be done with reference to the thrust block holding down bolts was to cut two extra holes in the seating aft of the others, all the other holes working in. The thrust shaft was then put in place again, and repaired as shown in the sketch Bridge pieces were made of strips of mild steel, and bolted to the top of the collar and on to the shaft. In addition a piece of angle iron was bent round and fastened by means of tap bolts, both to the shaft and the forward face of the first collar Another piece of angle iron was then bent round the shaft, and secured by tap bolts in order to form a sort of auxiliary collar to help the parts where they were fastened together, and to keep the crank shafting from working either forward or aft The necessary bearing for this collar was secured by bolting two stout hatches together, and shoreing them together in every conceivable manner from the roof of the thrust block recess and also from the floor. The auxiliary collar, therefore, ran up against the wood, as shown in the sketch, and this wood also acted as a means of steadying the shaft The bridge pieces were half-inch thick, and the angle iron was half-inch thick in the flange, while the bolts used were seven-eighths of an inch This repair was sufficiently satisfactory to enable the boat to proceed with the engines running slow after the packing had been removed from under the tunnel bearing keeps, for about 150 miles until a port of repair could be reached All this trouble might possibly have been avoided however, if the shaft had been thicker in diameter, and again if the junction between the collar and the thrust shaft had been rounded instead of left a sharp corner.

The above remarks are not intended to be in any way a treatise upon the subject of bearing and thrust shaft design, but it is hoped that they may have their use in presenting the subject in a somewhat fragmentary manner from the practical operating stand point, and may therefore be worth the attention of the marine engineer who has the necessary scientific qualifications for applying lessons taught by experience to the principles of marine engine design

LIVERPOOL MARINE ENGINEERS AND NAVAL ARCHITECTS.—The eleventh annual dinner of the Liverpool Marine Engineers and Naval Architects was held on the 18th December in the Exchange Station Hotel, Liverpool. Mr. A. S. Collard, J.P., presided, with Mr. G. Harradon as vice-chairman, and many influential personages were present, representative of the great engineering and naval architectural interests of Liverpool. The customary loyal toasts were submitted by the chairman and duly honoured. Mr. D. Beatson proposed as the first following toast, " His Majesty's Services," and remarked that recently in Liverpool, in the *Vanguard*, they had seen how in sea defence the " wooden walls and mariners of England " had been supplanted by the engineering science. Captain Ian Mackenzie Fraser, R.N., in replying, denied that there was any decline in national patriotism, and he demanded that the country should do its duty to the services which were organized for its defence. He considered that foreign nations were making progress greater than England on scientific matters, and those sciences referred to warlike equipments, and that the final arbitration in international disputes was war. Mr. R. R. Bevis proposed " The Steamship Trade of Liverpool," and referred to the death of Sir Alfred Jones, which he considered to be an almost irreparable loss, not only to the shipping and commercial communities of Liverpool, but to many of the colonies. The late Sir Alfred Jones was one of the greatest pioneers of the development of the steamship trade in Liverpool, and they were well able to judge of and appreciate his untiring energy in advancing the great industry of the port, though he recognised that amongst them there were many who were working on the same lines and ready to search for new spheres for their operations. Referring to the Workmen's Compensation Act, he said that though shipowners did not wish that men should suffer from the results of accidents met with in their employ, the method of preventing that suffering by means of the Workmen's Compensation Act was a wrong one, and was not equitable. In conclusion, he expressed the belief that the shipping industry had experienced the worst of the depression and that better times were ahead. Mr. Sydney Jones, in responding, said that the late Sir Alfred Jones was one of the most remarkable and most loyal citizens Liverpool had ever had. Wherever he went the fame of Liverpool was sure to follow, and he never tired of pressing forward its claims. Referring to the development of the steamship business during the past fifty years, he said that Liverpool claimed the premier place in this direction, and that her engineers and the naval architects were pre-eminent in the work of advancement. Her supremacy would always remain. Apart from having the best harbour, she was on the hinterland of the world's greatest industrial centre. Mr. C. Livingston proposed " The Liverpool Marine Engineers and Naval Architects." He said that Liverpool possessed a fine body of engineers and naval architects, and that it was due largely to them that the improved type of tonnage came about, and to the superintendents who were on the watch night and day, that the shipping industry was worked economically. The Chairman, in responding, said that Liverpool possessed the most experienced and the most capable marine engineers in the world. The progress made in producing for Liverpool the finest types of steamers afloat was due to them, and he could not understand why it was that Liverpool did not become a greater steamship-building centre. Concluding, Mr. Collard mentioned that in 1905 Mr. Grayson, as chairman, had inaugurated the Benevolent Guild which was associated with that society. It possessed invested funds amounting to £748, and was able to do much excellent work in helping their less fortunate brethren. He hoped they would all give it their heartiest support. It was subsequently announced that Mr. Grayson had given another £50 towards the fund, which now amounted to £800. Mr. A. T. Gibson proposed " The Guests." Professor Watkinson, in responding, to the toast, thought that there was great need for the British Government to support institutions for the cultivation of science as applied to the building of warships and other vessels. The German and American Governments generously supported schools for naval architecture and engineering science, and the British Government should do likewise. The toast of " The Chairman " was duly proposed and responded to.

OBITUARY.

The Late Sir Alfred Jones, K.C.M.G.

THE death of this great man has come as a shock to all who had the benefit of his acquaintance. How great a loss his death will be to many and diverse interests time alone can show. Though he was but sixty-three years of age at the time of his death, he had crowded immense activities into his life. Starting without advantages, either of money, position or influence, he long occupied a unique position in the shipping world. He was essentially a man of ideas, of initiative and of determination. He did not believe in being limited in his sphere of action by even the usual scope of a great shipowners' labours. When he first came into prominence as a partner in the firm of Elder, Dempster & Co., that business was confined to the West African trade, then a poor thing compared with what it is to-day. His ships used the Canary Islands as a port of call. He found that, in spite of the fertility of those islands, in spite of their unrivalled climate, the decline of the cochineal trade had deprived them of the backbone of their trade. He determined to exploit the islands. He fitted his ships for the carriage of the then despised banana. He encouraged the islanders to grow this fruit, and established distributing agencies for its sale and popularisation in this country. He built hotels and created a tourist traffic, and made the Canaries more prosperous than they had ever been. When the competition of beet sugar with the product of the cane had reduced politicians to despair of ever doing

The late Sir Alfred Jones, K.C.M.G.

anything for our West India possessions, he applied a similar procedure to Jamaica. He long ago recognised the immense possibilities of Canada, and purchased and developed the old Beaver line of steamers, then moribund, eventually handing it over, a great and forceful organization, to the Canadian Pacific Railway. For the general development of the West African trade, he provided banking facilities. For the benefit of its special trade in palm kernels, he erected mills in Liverpool. Recognising the possibilities of cotton growing in these and other regions under the British flag, he gave much time and thought and energy to the promotion of the work of the British Cotton Growing Association, an institution which will make a lasting mark on the trade of our country. His interest in the School of Tropical Medicine is well known, but it is not easy at this date to remember what an improvement has already been effected by the knowledge acquired through its discoveries and by the sanitary reforms which it has induced. He thought imperially and he believed that the only salvation for our country was to lead others to think as he did. With that object in view, he was always ready to grant passages to those who were anxious to study the larger problems of Imperial Rule. He would facilitate the visits of students to the West Indies. He made it easy for residents in the West Indies to send their children to the old country for their education. He wished to see the unemployment question solved, and the foreigner give place to the Briton in our Mercantile Marine. To this end he supported the Lancashire Sea Training Homes for Boys with no sparing hand. He improved the conditions of life in his own forecastles so as to attract our countrymen to the sea, his latest move having been the furnishing of three of his latest ships with libraries for the use of the men.

His brother-in-law and partner, Mr. Davey, died but a short while ago, and at the moment one fails to see how the many gaps which his loss has created can in any way be filled. But in any case the country is poorer by the loss of a man of originality and courage, of kindheartedness and enterprise, of activity and immense resource. He was at Kingston at the time of the Jamaica earthquake, and ever since that time he has appeared to be failing. The shock of that catastrophe seemed too much for him ever to shake off the unparalleled horror of the scene.

THE "OSCO" PARAFFIN BRAZING APPARATUS.

In the adjacent diagram we illustrate a new form of brazing apparatus which has recently been placed upon the market by Messrs. O. Shanks & Co., of Little King Street, Camden Town, London.

It will be generally recognised that the essential features of a good heating or brazing appliance, if first-class work is to be carried out, are general handiness and capacity for generating and concentrating sufficient heat. It may be admitted that there are many brazing lamps on the market, but most are heavy and cumbersome in character if their heat capacity is sufficient for effecting a brazing operation of average size. The main object in the design and arrangement of the "Osco" apparatus has been the production of a complete unit which can be easily transported and for which ordinary petroleum can be used as a fuel, owing to its cheap cost on the one hand and of it being readily obtainable anywhere, on the other.

As seen from the illustration the plan consists of a paraffin container with air pump and pressure gauge and an atmospheric blow pipe and a length of flexible metallic tubing. When the apparatus is to be put into operation, the paraffin is first poured into the tank until it is about two-thirds full, the tank is then closed and air is pumped in, to a pressure of about 40 pounds upon a square inch. The burner is then warmed by means of an igniter of special construction

which however is not shown in the illustration. This igniter is very simple in action and is adapted to burn paraffin oil and avoid the use of methylated spirit or petrol even for starting purposes. Two or three minutes is quite sufficient to warm the burner, after which the needle valve of the blow-pipe can be gently opened when a hot blue flame is emitted and immediately available for work. In the number one size of apparatus the flame can be varied under the control of the operator to any size within the range of 6-16 inches while the cost for fuel consumed is very low, being equivalent to about six pints of oil per hour.

We understand that not only is the whole vaporized in a perfectly even manner, but the risk of a smoky flame is practically nil.

It is claimed that the scope of utility of the apparatus is practically unlimited as far as engineering and metal trades are concerned and there is scarcely a class of work in which heat has to be locally applied for which this apparatus cannot be usefully employed.

WORSHIPFUL COMPANY OF SHIPWRIGHTS.—Mr. George Briggs, C.C., F.R.G.S., has been admitted a Freeman and Liveryman of the Shipwright's Company, and Mr. Frederick Perkins, C.C., F.R.G.S., Senior Past Master, has sent, for the sixteenth time, his annual donation of £10, for distribution at Xmas amongst the poor widows of above-named guild.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—The annual dinner, held in the Hall of The Armstrong College, Durham College of Science, Newcastle, on December 10th, was presided over by Mr. Summers Hunter, the president There was an attendance of about 200. The principal guests were the Duke of Northumberland, Lord Joicey, Sir Andrew Noble, the Deputy-Mayor, Sir Gerard Muntz, Sir Hugh Bell, Sir William Arrol, Sir Theodore Doxford, Sir Benjamin Browne, Principal W. H. Haddow, M.A., the President of the Institution of Engineers and Shipbuilders (Glasgow), and others. After the loyal toasts were proposed and received with acclamation, "The Imperial Forces" was proposed by Dr. G. B. Hunter, who referred to the Navy as the force to be kept in the front rank for strength, and to be maintained at full compass Next came the standing army, all too small, considering its responsibilities: then the Territorials, an arm of the nation which deserved full support: beyond these were the Colonial contingents to whom a tribute was due. He urged that more rifle ranges should be added throughout the country and that young men should undergo training in larger numbers. Captain H. B. Pelly, R.N, responded for the Navy, and Col. R Saxton White, V.D, in responding for the Land Forces, stated his view that the Territorial Forces must be made more efficient. Sir Benjamin Browne submitted the toast of the "Lord Mayor and Corporation of Newcastle," highly eulogizing the excellent work accomplished for the good of the town and people. The Deputy-Mayor responded The toast of the evening, "Prosperity to the North-East Coast Institution," was proposed by the Duke of Northumberland. He commented on the advantages accruing to the members of technical institutions by the interchange of ideas and transfer of thoughts, and in this direction the North-East Coast Institution had accomplished good work. Not only, however, had the members derived a conferred benefit by the discussions based upon their maturer experiences, but had given great help to the younger men, by the support rendered to the educational work. He signified his high appreciation of the value of such institutions and of admiration for those who devoted themselves to the work in connection with them. The President in responding said that the real and sensible progress of their own and similar institutions depended upon and was marked by the loyalty and harmony of the members in advancing the highest interests of their society, all working together for the greatest good The institution was entering its 26th year under favourable auspices, and looking forward to progress and good work. He urged that much required to be done to consolidate the Empire and improve the conditions for maintaining its strength The position and status of the Naval Engineer needed adjustment, and this, he believed, lay in the direction of a fusion of the executive and engineer branches. Sir Hugh Bell, in proposing "The Trade and Commerce of the North-East Coast," in which they were all interested, pointed out the value of capital relatively to labour and the position of a great captain of industry. For every £200 that he invested, a man was able to earn a wage and expend his earnings in maintaining a home and bringing up a family. The capitalist might receive from five to ten per cent. for his outlay of labour and capital, while the wage-earner received nearly £150. Lord Joicey, in responding, said they on the North-East coast were upholding their reputation by adopting the best and most approved appliances. Electric current was cheap, and it was to their advantage to employ it; they were in a better position than London in this respect. The coal industry had been passing through a crisis, accentuated or caused by an Act of Parliament which had upset all their customs and traditions, but which both employers and men were endeavouring to reasonably consider and carry into effect without serious stoppages to the production they were all interested in In closing, Lord Joicey expressed his belief that, owing to the improvements they had been making in their works, they would be in a position to take full advantage of the fuller flow of trade to which all were looking forward. "Kindred Institutions," proposed by Sir Theodore Doxford, was responded to by the President of The Institution of Engineers and Shipbuilders in Scotland (Mr. C. P. Hogg, Glasgow), and by The Principal of Armstrong College (W. H. Haddow, M.A.). Music and song—the latter especially—added greatly to the pleasure of the evening.

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REVIEWS.

Jordan's Tabulated Weights of Iron and Steel. By Chas. H. Jordan, M.I.N.A. 7/6 net. London: Messrs. E. and F. N. Spon, Ltd.

We have the sixth edition of Mr. Jordan's useful work before us, which enjoys a well-earned reputation among naval architects, shipbuilders and manufacturers. It is in convenient pocket size, with 640 pages. An alteration having been recently made in the Rules of Lloyd's Register of Shipping by the adoption of a decimal system for measuring the thicknesses of the various sections of steel, a series of such tables of Weights and Sectional Areas has been prepared in accordance with these arrangements and included in this edition. These tables are based upon the British Standard Ship Sections, as drawn up by the Engineering Standards Committee, which have been approved by the Committee of Lloyd's Register of Shipping. The arrangement of the contents on different coloured paper is very useful; it enables information to be quickly found and distinctly marks each separate subject one from the other. The first part is taken up mainly with weights of various iron sections per foot run, and the second part deals with areas of the various sections. The third part gives weights of steel sections in thicknesses of twentieths and fortieths of an inch and weights of steel and iron plating, and is followed by similar particulars for thicknesses in thirty-seconds of an inch. The tables are very complete throughout and the work is exhaustive so far as the weights and sections that are given

Brown's Nautical Almanac for 1910. Price 1/- net. Glasgow: James Brown & Co.

This well-known publication is before us for the coming year, and, as usual, is full of information extremely useful to all who are concerned with ships and shipping, and its popularity is shown by the long-continued support which has been accorded to the publication. The almanac commences with key charts to the coasts of England, Scotland and Ireland, which show the lights, beacons and buoys on all parts of the coast, with the names of towns upon these shores. In addition, key charts to the North Sea, the Kattegat, the Baltic, Gulfs of Bothnia and Finland are given, which show all lights that are to be found there. The pages relating to the Nautical Ephemeris have been entirely remodelled for this issue, two new pages having been arranged for each month. An important departure has been made by adding to the columns, containing the Noon values of the Planets, the amount of hourly variation, whereby the value for an intervening Greenwich date will be much more readily obtained than by the process of proportioning formerly necessary. The part devoted to the lunar elements has been recast entirely, as it has been rendered necessary to reconsider the method of tabulating the Lunar Right Ascension and Declination, from the increased interest that is now bestowed upon moon observations. In the present issue will be found, on pages III. and IV. of the Monthly Ephemeris, the Right Ascension and Declination for every two-hour period; and, moreover, the work of correcting for a given Greenwich date will be greatly facilitated by the rate of variation per ten minutes, which is also given. We find that other new tables have been included, such as semi-diameters and horizontal Parallaxes of Planets on page 94, and corrections have been given for the observed altitude of the Moon's upper and lower limbs. All tables and the revision of the variation of the compass have been carefully gone into and will be found to be as correct and reliable as possible.

Standard Compasses. By John Wilson Gillie. Wilson and Gillie, of North Shields.

We have received from Mr. Gillie a book which deals essentially with all standard compasses and gives general particulars of the essential characteristics of an efficient compass. Illustrations of Thomson's Patent Compass of 1876 Castle's Patent of 1866, and Kelvin's and James White's and Dobbie's novel suspensions of 1901 are given. This is followed by illustrations of Whyte's Patent suspension of 1906 and their Patent of 1908 upon horizontal springs, which are pivotted

on balls and sockets with chains opposed to one another. The book closes with particulars of Gillie's Patent of 1907 for an improved suspension, with illustrations of compass bearing and azimuths, whilst two pages are devoted to compass specifications and to spirit standard compasses, etc.

Messrs. Hayward, Tyler & Co., Ltd., have sent us their pocket diary for 1910, which is very neatly got up and contains much useful information and memoranda on water supply, friction in pipes, pressure in water pipes, measurement of water in streams, quantities delivered by pump barrels, etc., etc. The information given is not easily accessible elsewhere and the diary will be found of great service. We are informed that the diary is in great request.

The United States Metallic Packing Co., Ltd., have sent us a copy of their calendar for 1910, containing a reproduction in bas-relief, of the celebrated sculpture "The Lion Killer," in the Berlin Academy. The calendar is of exceptional interest and is an adornment to the wall.

MARINE BOILER EXPLOSIONS.

From the Board of Trade Reports.

REPORT No. 1873 has reference to the explosion from the main boiler of the s.s. *Harvest.* The explosion occurred on the 3rd August, 1909, the vessel at the time being in Morecambe Bay, about 5 miles E.S.E. of Walney Light, on a passage from Ulverston to Liverpool. No person was injured by the explosion. The boiler, which is of steel, is of the ordinary cylindrical single-ended marine type. It was last internally inspected, previous to the explosion, on March, 1909. A hole about ½ inch in diameter was formed in the bottom of the port furnace at the back end, through which the steam and hot water escaped, the pressure at the time being about 65 lbs. per square inch. The explosion was due to the plate having wasted by internal corrosion over an area measuring 4 inches by 2 inches, the thickness at the fracture being only that of paper. The observations of the Engineer-Surveyor-in-Chief are as follows: The explosion in this case was not of a serious character, and arose from the local corrosion of the furnace plate. The part affected was in a somewhat inaccessible position, and the wasting of the material must have been going on for a considerable time; and seeing that the bottoms of the furnaces had already required patching, presumably on account of corrosion, it would have been well at the inspection in March last, after careful examination, to have subjected the boiler to a suitable hydraulic test, when the defect might have been discovered.

Report No. 1874 has reference to the explosion from the boiler of the s.s. *Carbon.* The explosion occurred on the 12th July last, when the vessel was about one mile east of Zoze Point. No person was injured by the explosion. The boiler is made of steel, with the exception of the tubes, which are of iron, and is of the ordinary cylindrical, multitubular, single-ended marine type. A small hole about ¾ inch by ⅜ inch was formed in the bottom part of the shell plate, through which opening the contents of the boiler escaped. The explosion was due to the shell plate, forward of the forward boiler bearer, having become pitted internally and corroded externally, until it was locally unable to withstand the ordinary working pressure. The observations of the Engineer-Surveyor-in-Chief are as follows:—The explosion in this case was not of a serious nature. It, however, points to the necessity of owners of boilers placing them in the care of some competent person to advise them as to their upkeep and so prevent, if possible, any danger to life and property. The boiler does not appear to have been efficiently examined, otherwise the defective condition of the shell plate should have been observed, and in the case of such small boilers it is advisable that a suitable hydraulic test should be applied periodically, as a thorough internal examination is impracticable.

Report No. 1877 has reference to the explosion from a steam pipe on board the steam trawler *Recorder.* The explosion occurred on the 16th August, the vessel then being about 30 miles from the mouth of the Tyne. No person was injured by the explosion. The pipe was made of solid drawn copper, and was about 9 feet 4 inches long over all. It was 1 inch in internal diameter, by No. 14 S.W.G. (·08 inch) in thickness. A brass flange, 5 inches in diameter by ⅝ inch thick, was brazed on each end. The pipe conveying steam from the boiler to the water gauge column burst. The rupture commenced about 3 inches from the flange at the boiler end of the pipe, and extended longitudinally for about 3 inches, opening out at the centre to a width of about ¼ inch. Through the aperture thus formed, water and steam escaped at a pressure of about 160 lbs. per square inch. It has not been possible to examine the pipe, as it was cut up and melted before this inquiry was ordered. From the evidence taken, however, it would appear that the explosion was due to some defect in the material. The observations of the Engineer-Surveyor-in-Chief are as follows:—This report has reference to the explosion from a small pipe forming communication between the steam space of a boiler and the water gauge; but, the pipe having been destroyed before the inquiry was held, the cause of its failure has not been ascertainable, although it is suggested that it was weakness arising from a defect in the material.

Report No. 1882 deals with an explosion from a main steam pipe on board the s.s. *Frankdale,* a vessel of 4,836 tons gross, engaged in the general carrying trade. The explosion occurred when the vessel was off the Aberdeenshire coast, on a voyage from Hull to New York. No person was injured by the explosion. The pipe was of solid-drawn copper, 4¾ inches in diameter internally, and about ·23 inch thick. It measured about 10 feet 5¾ inches in length. A longitudinal crack, about 2¼ inches long, developed in the pipe, through which steam escaped. The stop valves were shut before the leak became serious. The explosion was due to the material of the pipe having been injured and rendered brittle by improper treatment in the fire, during the process of effecting repairs. In consequence of this, a crack developed in the pipe under ordinary conditions of working. The observations of the Engineer Surveyor-in-Chief are as follows:—In this case, a serious explosion may have been averted by the vigilance and discretion exercised by the engineers of the vessel. The failure of the pipe is attributed to the brittleness of the material, caused by improper heat treatment when being repaired, and the tests which have been made clearly show that the metal near the fracture possessed this quality. It is, however, remarkable that the pipe should have previously failed in a somewhat similar manner, and at very nearly the same position if, as implied, adequate provision is made for the movement of the pipe under working conditions.

Report No. 1865 deals with the explosion from the port main boiler of the s.s. *Penrith Castle.* The explosion occurred when the vessel was about 110 miles south-west of Queenstown. No person was injured by the explosion. The boiler is made of steel, and is of the ordinary cylindrical, single-ended, marine type. Two studs, each ⅞ inch in diameter and screwed 11 threads per inch, forming part of the chain studding at the crack in the fillet of the flange, at the forward end of the back ring of the port furnace, were suddenly blown out, and the water and steam escaped through the opening into the stokehold. The pressure of the steam at the time was 180 lbs. per square inch. The explosion was due to the corrosion of the threads of the two screwed studs, which finally became slack in the holes, and were blown out by the pressure within the boiler, under the ordinary working conditions. According to the evidence given at the inquiry, a longitudinal crack which had been developed in the crown of the back ring of the port furnace of the port boiler, about five years ago, was chain studded and caulked. This gave no trouble, and when the boiler was opened out for examination at Antwerp, on the 21st April last, the studs appeared to be quite tight and there was no sign of corrosion. The observations of the Engineer Surveyor-in-Chief are as follows:—Although cracks in furnaces are frequently made tight by chain studding, as in the present case, this method of repair is not reliable, for the studs are apt to become slack with the expansion of the plate under ordinary working conditions, with the result that corrosion ensues, and the studs are then liable to be blown out of position, possibly with serious consequences. Instances of such casualties are not lacking, and chain studding should only be regarded as a means of temporary repair.

Summary of Shipbuilding Returns of United Kingdom in 1909, arranged in order of Tonnage built by each Firm.

No.	Name of Firm.	Place.	No. of Ships.	Total Tons.†
1	Workman, Clark & Co.	Belfast	10	88,952
2	Swan, Hunter, Wigham Richardson Ltd.	Tyne	10	77,637
3	Vickers, Son & Maxim, Barrow, Ltd.	Barrow	—	60,200
4	Russell & Co.	Clyde	14	55,518
5	Northumberland Shipbuilding Co., Ltd.	Tyne	9	48,025
6	Irvine's Shipbuilding & Dry Docks Co., Ltd.	Hartlepool	11	37,004
7	Wm. Denny & Bros.	Clyde	—	33,504
8	Harland & Wolff, Ltd.	Belfast	6	29,708
9	Wm. Doxford & Sons, Ltd.	Wear	8	28,393
10	Wm. Hamilton & Co., Ltd.	Clyde	8	27,845
11	Fairfield Shipbuilding Co., Ltd.	Clyde	6	27,688
12	Chas. Connell & Co., Ltd.	Clyde	6	25,467
13	Scott's Shipbuilding & Engineering Co., Ltd.	Clyde	5	21,259
14	Greenock & Grangemouth Dockyard Co.	Clyde & Forth	10	20,317
15	Short Bros., Ltd.	Wear	8	20,237
16	A. McMillan & Son, Ltd.	Clyde	7	19,637
17	J. L. Thompson & Sons, Ltd.	Wear	5	19,269
18	Cammell, Laird & Co., Ltd.	Mersey	30	18,807
19	Ropner & Son	Tees	4	17,935
20	Hawthorn, Leslie & Co., Ltd.	Tyne	6	17,230
21	Sir W. G. Armstrong, Whitworth & Co., Ltd.	Tyne	10	15,964
22	J. Readhead & Sons	Tyne	4	15,352
23	Barclay, Curle & Co., Ltd.	Clyde	3	15,250
24	Sunderland Shipbuilding Co., Ltd.	Wear	6	13,706
25	Robert Thompson & Sons, Ltd.	Wear	6	13,488
26	Clyde Shipbuilding & Engineering Co., Ltd.	Clyde	7	13,305
27	Sir Raylton Dixon & Co., Ltd.	Tees	6	12,661
28	London & Glasgow Shipbuilding Co.	Clyde	1	12,129
29	A. Rodger & Co.	Clyde	4	11,339
30	Napier & Miller, Ltd.	Clyde	4	11,070
31	Caird & Co., Ltd.	Clyde	1	10,883
32	Craig, Taylor & Co., Ltd.	Tees	4	10,389
33	John Brown & Co., Ltd.	Clyde	6	10,154
34	Earle's Shipbuilding & Engineering Co., Ltd.	Humber	10	9,745
35	Wood, Skinner & Co., Ltd.	Tyne	5	8,590
36	Tyne Iron Shipbuilding Co., Ltd.	Tyne	3	8,423
37	D. & W. Henderson & Co., Ltd.	Clyde	4	7,625
38	Bartram & Sons	Wear	2	7,433
39	S. P. Austin & Son, Ltd.	Wear	5	7,029
40	John Crown & Sons, Ltd.	Wear	6	6,783
41	Caledon Ship & Engineering Co., Ltd.	Tay	7	6,667
42	Blyth Shipbuilding & Dry Docks Co., Ltd.	Blyth	10	6,276
43	Wm. Beardmore & Co., Ltd.	Clyde	2	,000
44	Ailsa Shipbuilding Co., Ltd.	Clyde	6	,980
45	Osborne, Graham & Co.	Wear	5	,950
46	Simons & Co., Ltd.	Clyde	—	5,870
47	R. Duncan & Co., Ltd.	Clyde	2	5,222
48	G. Rennie & Co.	Greenwich	19	5,205
49	Wm. Pickersgill & Sons	Wear	3	5,090
50	R. Craggs & Sons, Ltd.	Tees	2	4,972
51	Lobnitz & Co.	Clyde	23	4,605
52	C. H. Walker & Co., Ltd.	Chepstow	35	4,567
53	Hall, Russell & Co.	Aberdeen	13	4,520
54	Cook, Welton & Gemmell, Ltd.	Humber	20	4,538
55	R. Stephenson & Co., Ltd.	Tyne	1	4,386
56	Smith's Dock Co., Ltd.	N. Shields	20	4,322
57	Ramage & Ferguson, Ltd.	Forth	4	4,117
58	John I. Thornycroft & Co., Ltd.	S'ton	12	4,084
59	Cochrane & Sons	Humber	11	4,026
60	Yarrow & Co., Ltd.	Clyde	11	3,522
61	J. Samuel White & Co., Ltd.	E. Cowes	—	3,000
62	J. Blumer & Co.	Wear	1	2,838
63	Mackie & Thompson, Ltd.	Clyde	10	2,725
64	John Priestman & Co.	Wear	2	2,617
65	Wm. Harkess & Son, Ltd.	Tees	3	2,554
66	Ferguson Bros.	—	6	2,480
67	John Fullerton & Co.	Clyde	6	2,438
68	Campbeltown Shipbuilding Co.	Clyde	2	2,404
69	Joseph Scarr & Sons	Humber	12	2,150
70	Goole Shipbuilding & Repairing Co., Ltd.	Goole	5	1,915
71	Dublin Dockyard Co.	Dublin	5	1,808
72	Palmer's Shipbuilding & Iron Co.	Tyne	3	1,620
73	Lytham Shipbuilding & Engineering Co., Ltd.	Lytham	17	1,597
74	A. & J. Inglis, Ltd.	Clyde	1	1,561
75	J. P. Rennoldson & Sons	Tyne	6	1,552
76	Ardrossan Dry Dock & Shipbuilding Co.	Clyde	4	1,464
77	Dundee Shipbuilding Co., Ltd.	Clyde	4	1,407
78	Wm. Dobson & Co.	Tyne	1	1,387
79	W. H. Warren	Humber	6	1,300
80	Montrose Shipbuilding Co.	Tay	3	1,300
81	David J. Dunlop & Co.	Clyde	1	1,254
82	George Brown & Co.	Clyde	6	1,193
83	John Chambers	Lowestoft	18	1,170
84	Henry Scarr	Humber	7	1,130
85	Scott & Sons	Clyde	4	1,022
86	D. M. Cumming	Clyde	12	990
87	Hepple & Co., Ltd.	Tyne	8	945
88	Joseph T. Eltringham & Co.	S. Shields	3	937
89	Bow, McLachlan & Co., Ltd.	Clyde	5	934
90	The John Duthie Torry Shipbuilding Co.	Torry	7	892
91	Camper & Nicholson, Ltd.	Gosport	7	855
92	Alex. Hall & Co., Ltd.	Aberdeen	6	825
93	R. Williamson & Sons	Mersey	1	707
94	Murdock & Murray	Clyde	2	607
95	Ritchie, Graham & Milne	Clyde	13	540
96	John Reid & Co., Ltd.	Clyde	1	414
97	Larne Shipbuilding Co.	Larne	8	400
*1	Alley & MacLellan, Ltd	Clyde	12	2,430
*2	Fleming & Ferguson, Ltd.	Clyde	7	5,600
*3	Richardson, Duck & Co.	Tees	8	18,324
4	Alex. Stephen & Son, Ltd.	Clyde	5	21,353
*5	W. Gray & Co., Ltd	Tees	8	35,583

† Board of Trade gross tons register.
* Board of Trade gross tons register including erections.

List of Vessels Launched in 1909.

ENGLISH.

THE TYNE.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Bahia	Steel	Foreign	3,102	—	20,000
Rio Grande do Sul	,,	,,	3,102	—	20,000
Minhla	,,	British	1,300	—	900
Nyounghla	,,	,,	307	—	400
Yenang Young	,,	,,	307	—	400
Magwe	,,	,,	307	—	400
B.O.C.	,,	,,	116	—	—
B.O.C.	,,	,,	116	—	—
H.M.S. Newcastle	,,	,,	4,821	—	22,000
Posteiro	,,	Foreign	2,300	—	1,300

The Blyth Shipbuilding & Dry Docks Co., Ltd.

† May Scott	Steel	British	1,465	—	1,085
† Constantine	,,	,,	1,459	—	1,085
† Woodmere	,,	,,	682	—	550
3 Hopper Barges	,,	—	290ea	—	—
4 Hopper Barges	,,	—	450ea	—	—

W. Dobson & Co., Low Walker.

† Thurso	Steel	British	1,387	—	850

R. & W. Hawthorn, Leslie & Co., Ltd., Hebburn-on-Tyne.

t Torpedo Boats Nos. 33 & 34	—	British	328ea dis.	328ea	2,000
t H.M.S. Zulu	—	,,	1,080	1,080	15,500
Vollrath Tham	—	Foreign	5,807	5,807	2,020
Chapala, T.S. Tug	—	British	159	159	1,000
Protesilaus, T.S.	—	,,	9,528	9,528	6,000

Joseph T. Eltringham & Co., South Shields.

No. 271, Cargo Boat	—		515	—	600
No. 272, Trawler	Steel		211	—	490
No. 273, Trawler	,,		211	—	490

Hepple & Co., Ltd., South Shields.

* Espardarte	Steel	Foreign	56	—	200
* Titan	,,	,,	117	—	450
* Poodle Barge	,,	British	90	—	225
* Glenbrook	,,	,,	251	—	355
* Sir Joseph, Tug and Eroder	,,	,,	47	—	180
p No. 600 (Dredger)	,,	Foreign	16	—	10
* Mary Blake, Tug	,,	British	80	—	—
No. 602, Barge	,,	,,	138	—	—

W. P. Huntley, Hebburn-on-Tyne.

Wadley	—	British	40	—	—

The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne.

Savannah	—	British	6,300	—	3,200
Feliciana	—	,,	4,750	—	2,000
Parisiana	—	,,	6,27[illegible]	—	2,800
Errington Court	—	,,	5,100	—	2,550
Queen Eugenie	—	,,	4,850	—	2,260
Queen Maud	—	,,	4,850	—	2,200
Netherpark	—	,,	4,850	—	2,200
Gerania	—	Foreign	5,525	—	2,470
Himalaia	—	,,	5,525	—	2,470

Palmer's Shipbuilding & Iron Co., Ltd., Jarrow-on-Tyne.

No. 35 Torpedo boat	Steel	British	310	—	4,000
No. 36	,,	,,	310	—	4,000
Viking, Destroyer	,,	,,	1,000	—	15,500

Have also engined the s.s. Parisiana 2800, and s.s. Tortona, 5000 I.H.P.

John Readhead & Sons, Ltd., South Shields.

Trelissick	—	British	4,168	4,526	[illegible]
Highcliffe	—	,,	3,238	[illegible]	[illegible]
Treveal	—	,,	4,160	[illegible]	[illegible]
Zurichmoor	—	,,	3,780	4,022	[illegible]

J. P. Rennoldson & Sons, South Shields.

* Knowl Grove	Steel	British	[illegible]	—	475
† Heroic	,,	,,	208		1,074
Seaham, Paddle	,,	,,	[illegible]		350
† Nyora	,,	,,	[illegible]		1,220
† Dewan	,,	,,	282		1,225
† Abeille	,,	Foreign	[illegible]		650

Smith's Dock Co., Ltd., North Shields, and Middlesbrough.

388 Screw	Steel		248		475
398, Screw	,,		86		240
399 and 400	,,		210ea		425ea
401 Screw	,,		287	—	[illegible]
402 ,,	,,		200		400
403 ,,	,,		108		280
404 ,,	,,		[illegible]		400
405 ,,	,,		88		240
406 ,,	,,		88		230
407 ,,	,,		[illegible]		240
408 ,,	,,		207		300
409 ,,	,,		[illegible]		[illegible]
410 and 411 Screw	,,		240ea		475ea
412 and 413	,,		128ea		480ea
414 Screw	,,		224		450
415 and 416 Screw			[illegible]		[illegible]

† Triple. *t* Turbine. *p* Petrol. * Compound

R. Stephenson & Co., Ltd., Hebburn-on-Tyne.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Navarra	Steel	British	4,386	—	1,900

Swan, Hunter & Wigham Richardson, Ltd., Wallsend and Walker-on-Tyne.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Simcoe	Steel	Colonial	977	—	1,800
Dearne	,,	British	1,227	—	2,150
Drottning Victoria, Car Ferry	,,	Foreign	4,988	—	5,800
Telconia, Cableship	,,	British	1,050	—	1,200
Keyport	,,	Colonial	1,752	—	650
Saga	,,	Foreign	3,025	—	3,700
Annaberg	,,	,,	5,865	—	3,150
Florinda	,,	,,	2,332	—	1,750
Kaministiquia	,,	Colonial	2,173	—	1,220
Querida	,,	British	1,380	—	870
Danubian (Oil Tank)	,,	,,	5,244	—	2,700
Salvador	,,	,,	1,150	—	1,300
Natalia	,,	Foreign	2,333	—	1,750
Patella, Oil Tank	,,	British	5,827	—	2,800
San Antonio	,,	,,	5,385	—	2,660
British Sun	,,	,,	6,005	—	2,800
Tortona	,,	,,	8,157	—	5,000
Prince Rupert	,,	Colonial	2,850	—	6,500
Newona	,,	,,	2,179	—	1,220
Keywest	,,	,,	1,725	—	650
Penarth Floating Dock	,,	British	3,750	—	—
Port Colborne	,,	Colonial	1,729	—	700
City of Colombo	,,	British	6,534	—	3,450

The Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on-Tyne.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Lancer	Steel	British	1,363	1,420	1,420
† Boverton	,,	,,	3,110	3,550	1,850
† Kaduna	,,	,,	3,050	5,220	2,200

Wood, Skinner & Co., Ltd., Bill Quay, Newcastle-on-Tyne.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Kingswear	Steel	British	1,457	—	1,100
† Tynemouth	,,	,,	2,222	—	1,375
† Barmoor	,,	,,	2,225	—	1,375
† Belgique	,,	Foreign	2,124	—	1,200
† Steersman	,,	British	562	—	660

WEAR.

S. P. Austin & Son, Ltd., Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu. erect.	I.H.P
† The Stewarts Court	Steel	British	813	—	830
† Wm. Corry	,,	,,	2,660	—	1,500
† Regis	,,	,,	1,370	—	1,020
† Lady Helen	,,	,,	811	—	830
† Devereux	,,	,,	1,375	—	1,000

John Blumer & Co., Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu. erect.	I.H.P
Oakmoor	Steel	British	2,838	3,109	1,550

Bartram & Sons, Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu. erect.	I.H.P
†*Tyninghame	Steel	British	3,740	—	1,880
†*Vosges	,,	Foreign	3,693	—	1,850

John Crown & Sons, Ltd., Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu. erect.	I.H.P
* Braeside	Steel	British	406	—	550
* Cairnside	,,	,,	603	—	550
† Quickstep	,,	,,	1,446	—	1,045
† Axwell	,,	,,	1,442	—	1,000
† Bromsgrove	,,	,,	1,444	—	1,045
† Bondicar	,,	,,	1,442	—	1,000

William Doxford & Sons, Ltd., Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu. erect.	I.H.P
Kurow	—	British	2,580	—	1,550
Emma Sauber	—	Foreign	2,475	—	1,300
Inland	—	,,	2,290	—	1,250
Nyland	—	,,	3,321	—	1,450
Vogesen	—	,,	3,701	—	1,500
Dalemoor	—	British	4,124	—	1,600
Cloutsham	—	,,	4,950	—	2,500
Edilio		Foreign	4,950	—	2,500

Osbourne, Graham & Co., Hylton, Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu. erect.	I.H.P
† Monitoria	Steel	British	1,904	2,136	1,180
† Howden	,,	,,	1,020	1,020	650
† Alfred Kreglinger	,,	Foreign	1,029	1,029	650
† Togston	,,	British	1,057	1,057	650
† Harlingen	,,	,,	940	1,083	650

Wm. Pickersgill & Sons, Ltd., Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu. erect.	I.H.P
Ambiorix	—	Foreign	1,472	—	—
Pelica	—	British	2,144	—	—
Boduognat	—	Foreign	1,474	—	—

J. Priestman & Co., Southwick, Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu. erect.	I.H.P
† Therèse	Steel	Foreign	1,302	1,302	1,055
† Fernande	,,	,,	1,315	1,315	1,055

Short Brothers, Ltd., Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu. erect.	I.H.P
Legia		Foreign	1,904	2,477	1,230
Brugia	—	,,	1,908	2,471	1,230
Dania	—	,,	1,445	1,578	1,020
Hartside	—	British	2,740	3,095	1,620
Heatherside	—	,,	2,766	3,110	1,620
Bruxellia	—	Foreign	1,915	2,475	1,230
Cacique	—	British	4,557	6,159	3,150
Russia	—	Foreign	2,696	3,024	1,615

† Triple. * Compound.

The Sunderland Shipbuilding Co., Ltd., Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Harlesden	Steel	British	4,333	—	2,375
Polvarth	,,	,,	3,146	—	1,720
Hébé	,,	Foreign	1,554	—	1,170
Mapleton	,,	British	1,781	—	935
Germaine	,,	Foreign	1,390	—	1,055
Danae	,,	,,	1,500	—	1,170

Joseph L. Thompson & Sons, Ltd., Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Brinkburn	Steel	British	3,581	4,034	2,100
Kingsgate	,,	,,	3,827	4,368	1,900
South Atlantic	,,	,,	3,717	4,235	1,896
Wakefield	,,	,,	4,072	4,695	2,100
Collingham	,,	,,	4,072	4,695	2,100

Robert Thompson & Sons, Ltd., Southwick Yard, Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Morien	Steel	British	834	974	900
† Leversons	,,	,,	1,774	1,848	1,300
† Relillio	,,	,,	2,398	2,636	1,420
† Rubio	,,	,,	2,395	2,637	1,420
† Monkstone	,,	,,	3,097	3,563	1,750
† Karuma	,,	,,	2,990	3,379	1,825

TEES AND HARTLEPOOLS.

R. Craggs & Sons, Ltd., Tees Dockyard, Middlesbrough.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T. inclu. erect.	I.H.P.
Conrad Mohr	Steel	Foreign	4,012	—	2,260
Tancarville, Coaling Barge	,,	,,	960	—	—

Both built on Isherwood System.

Craig, Taylor & Co., Ltd., Stockton-on-Tees.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T. inclu. erect.	I.H.P.
† Magdalena	—	Foreign	2,390	—	1,260
† Boscawen	—	British	2,120	—	1,435
† Ashtree	—	,,	1,579	—	1,085
† Benwood	—	,,	4,300	—	2,050

Sir Raylton Dixon & Co., Ltd., Middlesbrough-on-Tees.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T. inclu. erect.	I.H.P.
Paulina	Steel	Foreign	2,672	2,870	1,480
Victor Hugo	,,	,,	2,290	2,480	1,400
Char (Barge)	,,	British	340	340	—
Westgarth	,,	,,	1,553	1,584	1,200
Rochester City	,,	,,	1,280	1,410	935
No. 547 s.s.	,,	,,	4,520	5,900	2,200

W. Gray & Co., West Hartlepool.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T. inclu. erect.	I.H.P.
Eretza-Mendi	—	Foreign	4,463	—	2,000
Bjornstjerne Bjornson	—	,,	6,387	—	2,500
Rossano	—	British	4,096	—	1,600
Harpeake	—	,,	5,130	—	2,200
Caterino	—	,,	4,096	—	1,600
Breynton	—	,,	5,182	—	2,000
Hargrove	—	,,	1,712	—	1,250
Rachel	—	,,	4,312	—	1,900

W. Harkess & Son, Ltd., Middlesbrough.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T. inclu. erect.	I.H.P.
† Uromi	Steel	British	962	—	1,000
† Webburn	,,	,,	800	—	800
† Graceful	,,	,,	782	—	900

Irvine's Shipbuilding and Dry Dock Co., Ltd., West Hartlepool.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T. inclu. erect.	I.H.P.
No. 168	—	British	1,440	—	2,150
No. 169	—	,,	1,542	—	850
Nos. 170, 171	—		4240ea	—	1,900ea
No. 172	—	Foreign	2,050	—	1,050
Nos. 309, 310	—	British	3425ea	—	1,600ea
Nos. 311, 312	—	,,	4105ea	—	1,800ea
No. 313	—	,,	4,240	—	2,100
No. 486	—	,,	4,210	—	1,800

Ropner & Sons, Ltd., Stockton-on-Tees.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T. inclu. erect.	I.H.P.
† Bismarck		Foreign	4,938	—	2,250
† Holtby	—	British	4,030	—	1,950
† Gladstone	—	Foreign	4,927	—	2,250
† Pikepool	—	British	4,040	—	1,930

Richardson, Duck & Co., Stockton-on-Tees.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T. inclu. erect.	I.H.P.
Tintern Abbey	—	British		1,952	1,150
2 Lighters	—	Foreign	—	226	—
Thessaly	—	British		4,370	2,400
Edenmore	—	,,	—	4,007	1,750
Dalserf	—	,,		1,920	1,250
Dalveen	—	,,	—	1,920	1,250
Rustington	—	,,	—	3,883	1,800

HUMBER.

Cochrane & Sons, Selby.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Notre Dame des Dunes	Steel	Foreign	458	—	720
Claudius	,,	British	285	—	530
Haller	,,	,,	679	—	800
Canada	,,	Foreign	483	—	750
Shotton	,,	British	299	—	450
Elite	,,	Foreign	457	—	760
Washington	,,	British	208	—	430
Lombard	,,	,,	272	—	430
Albatroz	,,	Foreign	327	—	500
Varanis	,,	British	240	—	420
No. 458	,,	,,	285	—	550

All Trawlers.

† Triple.

Cook, Welton & Gemmell, Ltd., Beverley.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† 2 Trawlers	Steel	British	170ea	—	375ea
* Handyman	,,	,,	86	—	350
† 2 Trawlers	,,	,,	324ea	—	550ea
† 3 Trawlers	,,	,,	213ea	—	265ea
† Kong Frederik III.	,,	Foreign	259	—	450
† 3 Trawlers	,,	British	219ea	—	400ea
† Consort	,,	,,	181	—	380
† Calphurnia	,,	,,	283	—	530
m Tetney	,,	,,	47	—	42
† 2 Trawlers	,,	,,	279ea	—	530ea
† Nemrod	,,	Foreign	226	—	450
† No. 192	,,	British	349	—	560

Earle's Shipbuilding & Engineering Co., Ltd., Hull.

Macquarie	—	British	535	—	750
Kelso (hull only)	—	,,	1,293	—	—
Aaro	—	,,	2,604	—	2,400
Yokohama	—	,,	291	—	550
Sun II., III.	—	,,	198ea	—	690ea
La Loire	—	,,	604	—	1,100
Nero (hull only)	—	,,	1,257	—	—
Bull Lightship	—	,,	165	—	—
Livorno	—	,,	2,600	—	—

Goole Shipbuilding and Repairing Co., Ltd., Victoria Shipyard, Goole.

Alphar (Pontoon)	—	British	500	—	—
* Retriever (Cattle Steamer)	—	,,	675	—	500
* Breaksea	—	,,	305	—	300
* No. 2 Goole (Tug)	—	,,	85	—	120
* Gladys (Passenger Boat)	—	,,	350	—	400

Joseph Scarr & Sons, Beverley and Howden.

Noble	—	British	—	G.T. 140	—
Trent and Derwent	—	,,	—	125ea	—
Juno	—	,,	—	140	—
Success II.	—	,,	—	160	50
Venus, Mars & Mercury	—	,,	—	250ea	—
No. 271	—	,,	—	140	—

Howden Yard.

* No. 321	Steel	British	—	—	350
Hugo	,,	,,	—	210	—
No. 8	,,	,,	—	110	—

Henry Scarr, Hessle.

Welfare and Barbara	Steel	British	140ea	—	—
Neptune and Uranus	,,	,,	300ea	—	—
Jupiter and Saturn	,,	,,	90ea	—	—
* Sun	,,	,,	70	—	60

W. H. Warren, New Holland.

G. F. B.	Steel	British	180	—	—
Voluta	,,	,,	120	—	—
Elma A.B.	,,	,,	180	—	—
Atlantic and Pacific	,,	,,	320ea	—	—
W.N.	,,	,,	240	—	250

THAMES

Beaching Bros., Ltd., Great Yarmouth.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect	I.H.P.
* G. A. W.	Wood	British	72	—	75
* Pimpernel (Steam Drifter)	,,	,,	67	—	75
* Morrison	,,	,,	80		75

John Chambers, North Side of Harbour, Lowestoft.

† Qui Sait	Wood	British	82	—	200
Boy Ramah	,,	,,	58	—	—
* E. B. C.	,,	,,	59	—	130
* Guiding Light	,,	,,	59	—	130
* Hawthorndale	,,	,,	59	—	130
* Tuberose	,,	,,	60	—	130
* Launch Out	,,	,,	66	—	130
* London County	,,	,,	82	—	140
* H. F. E	,,	,,	57	—	130
* Friendly Star	,,	,,	57	—	130
* W. Elliott	,,	,,	59	—	130
* G. E. S.	,,	,,	59	—	130
† True Friend	,,	,,	83	—	200
* John Alfred	,,	,,	81	—	175
* Golden Spray	,,	,,	59	—	130
* Boy Eddie	,,	,,	58	—	130
Iceni	,,	,,	57	—	
* Rambling Rose	,,	,,	59	—	130

Crabtree & Co., Ltd., Great Yarmouth.

Lassie II Steam Drifter	Steel	British	84	—	175
S.S. 119, Screw Tug	,,	Foreign	35		100

Edwards & Co., Ltd., Millwall.

* Vesta II	Steel	British	60	—	130
599	,,	Foreign	15	—	75
600	,,	,,	[illegible]	—	—
* Tonbridge Castle	,,	British	[illegible]	—	26
602		Foreign	75		
* 603		,,	20		140
605		,,	15	—	—
* 606		,,	[illegible]		110
607		,,	57	—	
608, 609, 610			300		

* Compound. † Triple. m Motor.

Fellows & Co., Great Yarmouth.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Ruler of the Seas (Steam Drifter)	Steel	British	80	—	—
Gleneme (Steam Drifter)	Wood	,,	79	—	—
Madis	,,	,,	79	—	—
Clara and Alice	,,	,,	79	—	—
Unsold (Sailing Smack)	,,	Unsold	55	—	—
Hawk (Barge)	Steel	,,	60	—	—

Forrest & Co., Ltd., Wyvenhoe.

* No. 614 & 615, Pinnaces	Wood	British	30	—	300
No. 617, Celia, Slg. Yacht	,,	,,	48T.M.	—	—
No. 618, Pinnace	,,	,,	18	15	—
* 619 Morvern, Stm. Yacht	Steel	,,	43T.M.	—	130
620 Aline, Slg. Yacht	Wood	,,	41T.M.	—	—
621 & 623, Lifeboats	,,	Foreign	24	15	—
622, Motor Launch	,,	,,	3	—	18
* 624, Sultan, s.w. steamer	Steel	British	98	—	130

G. Rennie & Co., Greenwich.

Camel Nos. 1 & 2, 1088-9	Steel	British	700ea dis.		—
* Birchrock, 1092	,,	,,	120	—	400
m Fire Float, 1093	,,	Foreign	20	—	60
* Alan No. 1, 1100	,,	British	80	—	250
* Harbour Vessel, 1101	,,	Foreign	75	—	200
* Small Tug, 1102	,,	,,	10	—	60
* Tug, 1103	,,	,,	70	—	250
* Train Wagon Ferry	,,	,,	550	—	350
† Twin-Screw Tunnel Vessel	,,	,,	780	—	1,200
6 Lighters	,,	,,	300ea	—	—
1 Barge, 1100	,,	,,	100	—	—
2 Passenger Barges, 1105 1106	,,	,,	100ea	—	—

Rowhedge Iron Works Co., Ltd., Rowhedge, Colchester.

‡‡Sara Thomson, Lch. Tug	Steel	British	9	—	25
f Shamrock, Inspect. Tug	—	Exported	8	—	23
‡‡Nos. 45, 52, 53	—	,,	4ea	—	15ea
‡‡No. 50	—	,,	6	—	25
f S. 48, S.W.	—	,,	40	—	40
S. 63, 70-ton Barge	—	,,	—	—	—

ENGLISH CHANNEL.

Camper & Nicholson, Ltd., Gosport.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect	I.H.P.
mHoshi (Yacht)	Wood	British	32	—	60
mMaga (Yacht)	,,	,,	10	—	30
* Thordis	,,	,,	26	—	80
Bryony (Yacht)	,,	—	7	—	—
† Miranda (Yacht)	Steel	,,	770	—	1,600
Folly (Yacht)	Wood		7	—	—
mSquirt III (Yacht)	,,	—	3	—	60

R. Cock & Sons, Ltd., Appledore.

Annie Reece, 3-mast schnr	Steel	British	140	—	—
2 Steel Barges, two-bowed	—	,,	60	—	—

Cox & Co. (Engineers), Ltd., Falmouth.

* 132, Twin-screw Tug		British	174	—	1,000
* 133	—	,,	173		1,000

John Thomas Crampton, Albion Shipyard, Landport, Portsmouth.

26 Floating Stages			600		—
1 Floating Target			60		—
1 Barge			120		—
13 Boats			15		—
4 Steam Launches			40		1,500

J. G. Fay & Co., Southampton.

The Nun, Pleasure Yacht	Wood Cutter	British	5	—	—

Hartley Mead, East Cowes, I.O.W.

Lady Belle (Yawl)	Wood	British			
Motor Launch	Wood		6		6

Philip & Son, Ltd., Dartmouth.

Badia, Vinca (S. Tugs)	Steel	British	150ea		[illegible]
4 52½ ft Admiralty Launches			40ea		85ea
Hauley, Ferry Launch			10		[illegible]
White Heather (Cutter)			[illegible]		
Vulcan (St. Tug)	Steel		20		[illegible]
Venture (Wood Tug)			[illegible]		[illegible]
Sewer, small boats and machinery			[illegible]		[illegible]

John I. Thornycroft & Co., Ltd., Southampton.

Paso de San Lorenzo	Steel	Foreign	70		[illegible]
Paso de Martin Garcia			702	—	[illegible]
No. 515			10		
No. 516			100		
S.Y. Napsugar			14		[illegible]
S.Y. Miranda		British	[illegible]		[illegible]
t H.M.D. Nubian		British Admiralty	[illegible]		[illegible]
530		British	[illegible]		[illegible]
531			130		[illegible]
532			130		[illegible]
[illegible]			130		[illegible]
[illegible]		Foreign	130		[illegible]

And [illegible] Motor Boats.

† Triple. * Compound. ‡‡ Compound Surface Condensing. m Motor. f Compound Non-Condensing. t Turbine.

Simpson, Strickland & Co., Ltd., Dartmouth, Devon.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
6 Sailing Boats, etc. ..	—	Foreign	14	14	—
† Armstrong ..	Steel	British	71	36	300
† No. 744 S.L. ..	,,	Foreign	9	6	76
‡‡No. 748, S.L. ..	,,	,,	7	3	30
‡‡No. 749, S.L. ..	,,	,,	9	3	40
16 Sailing boats, etc.	—	,,	43	43	—
*m*2 Motor Launches ..	Steel	,,	11	5	104
† No. 750 S.L. ..	,,	British	7	4	62
‡‡Totnes, Steel Tug ..	,,	—	31	4	180
‡‡No. 711 S.L. ..	,,	—	6	6	23
a No. 752, S.L. ..	,,	—	2	2	7
*m*No. 753, Steel motor launch.	,,	Foreign	—	5	38
† No. 755, S.L. ..	,,	,,	4	2	70
No. 756, Lifeboat ..	,,	—	1	1	—
† No. 757, S.L. ..	,,	—	5	3	34
Machinery only ..	—	—	—	—	590

George & Thomas Smith, Ltd., Rock Channel Shipyard, Rye, Sussex.

E.M.W., Sailing North Sea Trawlers ..	Wood	British	59	46	—
C.E.S. ..	,,	,,	59	46	—
Trevone ..	,,	,,	59	46	—
Godrevy ..	,,	,,	59	46	—

Stow & Sons, Shoreham.

*m*Memory (Sailing Yacht having aux. power) ..	Wood	British	37	—	23
*m*Vanderdecker (Sailing yacht having aux. power) ..	,,	,,	52	—	34

J. Samuel White & Co., Ltd., E. Cowes.

Torpedo Boat Destroyers, Shallow Draught Vessels for special service, special Steamboats for Warships..	—	–	3,000	—	41,926

William White & Sons, Vectis Works, Cowes, I. of. W.

* Floating Bridge ..	Steel	—	98	—	100
* 2 Steam Launches ..	Wood	—	20ea	—	80ea
* Steam Launch ..	,,	—	9	—	30

THE OUSE.

Edward Hayes, Stony Stratford.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Etienne Watel ..	Steel	Foreign	20dis.	—	70
* Ramtirth ..	,,	British	15dis.	—	35

BRISTOL CHANNEL.

Isaac J. Abdela & Mitchell, Ltd., Brimscombe, nr. Stroud.

Name of Vessel.		Built of	Owners	G.T. Regis	G.T. inclu. erect.	I.H.P.
Miloca ..	Steam	Steel	—	24	—	80
Lulu ..	,,	,,	—	7	—	40
Pocas Leitao ..	,,	,,	—	9	—	80
Triumpho ..	,,	,,	—	14	—	65
S. Raymundo ..	,,	,,	—	4	—	30
No. 1144 ..	,,	,,	—	3	—	16
No. 1197 ..	—	,,	—	64	—	—
Vencedora ..	,,	,,	—	7	—	40
No. 1198 ..	—	,,	—	64	—	—
Dora ..	Motor	,,	—	5	—	15B.H.P.
No. 1145 ..	Steam	,,	—	3	—	16B.H P.
Freda ..	Motor	,,	—	1	—	3B.H P.
No. 1185 ..	—	,,	—	26	—	—
No. 1174 ..	Steam	,,	—	25	—	160
Also 6 steel boats and engines.			—	—	—	420

Edward Finch & Co., Ltd., Chepstow.

2 Steel Lighters, 100 ft. × 20 ft × 7 in.	105	—	—
2 Do. 65 ft × 18 ft × 6 in.	60	—	—
2 Do.,100 ft. × 21 ft. × 8 in.	250	—	—
1 Steel Hull, 58 ft × 14 ft. × 6 in.	—	—	—
2 Steel Lighters, 80 ft. × 18 ft 6 in × 6 ft	100	—	—

C. H. Walker & Co., Ltd., Sudbrook Shipyard, Mon.

7 Admiralty Horse Boats, S. 61, 62, 63, 74, 75, 76, 77	Steel	British	18ea	—	—
8 to 17, Square Sections Nos. 93 to 102	,,	Foreign	2,230	—	—
18 to 21 ,, Nos. 103 to 106	,,	,,	571	—	—
22 to 26 ,, Nos 107 to 111		,,	1,120	—	—
27 to 35 ,, Nos. 42 to 50	,,	—	511	—	—

MERSEY.

Isaac J. Abdela & Mitchell, Ltd., Queen's Ferry, nr. Chester.

Name of Vessel	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
‡‡Provencal 17 ..	—	Foreign	70	—	200
‡‡Provencal 19 ..	—	,,	60	—	220
Section ..	—	,,	40	—	—

Cammell, Laird & Co., Ltd., Birkenhead.

† 9 Single screw Tugs ..	Steel	Foreign	94ea	—	300ea
t Renard, H.M.S. Torp boat Destroyer ..	,,	British app. 840			12,500
Toxteth, Coal Barge ..	,,	,,	897	—	—
‡‡Guanbacoa, Double-ended Ferry Boat ..	,,	Foreign	389	—	700

* Compound. † Triple. *m* Motor. *a* Quadruple. ‡ High Pressure. *t* Turbine. ‡‡ Compound Surface Condensing.

Tranmere Shipyard.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
t Ucayalu & Huallaga ..	Steel	Foreign	4,100ea	—	9,100ea
† Highland Laddie ..	,,	British	7,300	—	5,600
317 Pontoon ..	,,	,,	52	—	—
318 ,, ..	,,	,,	336	—	—
319 ,, ..	,,	,,	42	—	—
320, Lighter ..	,,	Foreign	6	—	—
‡‡Don Tomas and Don Eduardo	,,	British	60ea	—	350ea
323, Iron Pontoon ..	—	,,	32	—	—
‡‡Axholme ..	Steel	,,	126	—	194
‡‡Onward ..	,,	,,	37	—	80
326, Lighters ..	,,	,,	84	—	—
‡ 329, S.W. Launch ..	,,	,,	29	—	50
332 Lighter ..	,,	—	128	—	—
333 ,, ..	,,	—	180	—	—
336 S.S. Tug ..	,,	,,	55	—	210
341, Buoy ..	,,	,,	8	—	—

Garston Graving Dock & Shipbuilding Co., Ltd., Garston, Liverpool.

No. 76, Automatic Gas Light Vessel for The Honourable Corporation of Trinity House.

* Dunster Castle (Schooner)	Steel	British	155	—	271

Isaac Pimblott & Sons, Weaver Shipyard, Northwich.

* Launch ..	Wood	Foreign	6	—	22
4 Lighters ..	Steel	,,	60ea	—	—
4 Lighters ..	,,	,,	8ea	—	—
* Steam Barge ..	Wood	,,	14½	—	35
* Launch ..	,,	,,	6	—	22
4 Lighters ..	Steel	,,	40ea	—	—
2 Lighters ..	,,	,,	50ea	—	—
* Launch ..	Wood	,,	7	—	35
* Twin-screw Tug ..	Steel	,,	38	—	120

Thomas Summers & Sons, Ltd., Liverpool.

No. 1127, Tug (hulls only) .	Steel	British	50	—	—
No 1128, Launch	,, Wood	,,	15	—	—

Vickers, Sons & Maxim, Ltd., Naval Construction Works, Barrow-in-Furness.

H.M.S Vanguard ..	British Gov.
H M.S. Liverpool ..	British Gov.
São Paulo ..	Brazilian Gov
Scouts Bahia and Rio Grande do Sul (Machinery only) ..	Brazilian Gov.
Steam Ferry, Jose Marque ..	Brazilian Gov.
Earl Grey (Ice Breaker) ..	Canadian Gov.
Floating Dock, Northern Nigeria	Crown Agents for Colonies.
Various Small Vessels.	

Total Displacement Tonnage 60,200
Total Indicated Horse Power 122,110

William Walker, Maryport, Cumberland.

* Norrie ..	Steel	British	107	—	125

D. Williams, Portmadoc.

Isallt, 3-masted Schooner ..	—	British	132	—	—

R. Williamson & Sons, Workington, Cumberland.

† Petriana ..	Steel	British	707	—	582

W. J. Yarwood & Sons, Northwich, Cheshire.

* Assurance, Screw Coasting Type ..	Steel	British	203	—	210
No. 121, Pneumatic Drilling Raft, for blasting purposes	,,	,,	—	—	—
* Magical, Screw Barge ..	Steel	,,	50	—	54
* Docena ..	,,	,,	52	—	26
No. 127 A, B and C, 3 Cattle Barges ..	,,	Foreign	380ea	—	—
No. 128, Pontoon with erection for transhipping grain	,,	British	60	—	—
Apollo, Barge ..	,,	,,	56	—	—
* Baukhall, Screw ..	,,	,,	50	—	54
* Brazilea, Screw Launch Tug	,,	Foreign	30	—	52
No. 135 A and B, 2 Barges	,,	,,	73ea	—	—

THE RIBBLE.

Lytham Shipbuilding and Engineering Co., Ltd., Lytham, Lancs.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Samuel Baker, Side Paddle .	Steel	British	200	—	220
* Spake, Sternwheeler ..	,,	,,	160	—	160
Nos. 396/7, Lighters ..	,,	,,	126ea	—	—
* Vampire, Single-screw Launch	,,	,,	60	—	160
Schiope, Twin-screw Launch	,,	Foreign	60	—	120
Nos. 402/3, Canoes ..	,,	—	45ea	—	—
* Brigg, Twin-screw Cargo Steamer ..	,,	British	133	—	160
* Forward, Single-screw Launch	,,	Foreign	50	—	60
Nos. 406/7, Sternwheelers ..	,,	,,	60ea	—	100
† No. 408, Amazon River Passenger & Cargo Steamer .	,,	,,	319	—	600
* S. Thomé Single-screw Tug	,,	,,	50	—	110
Nos. 410/12, Canoes ..	,,	—	45ea	—	—

ROYAL DOCKYARDS.

H. M. Dockyard, Portsmouth.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
t Neptune, 1st-class battleship	Steel	—	19,900 dis	—	25,000

H. M. Dockyard, Pembroke.

t H.M.S. Bellona ..	Steel	—	3,350 dis	—	18,000
t H.M S Blanche ..	,,	—	3,350 ,,	—	18,000

* Compound. *t* Turbine. † Triple. ‡‡ Compound Surface Condensing. ‡ High Pressure.

LIST OF VESSELS ENGINED IN 1909.

Amos & Smith, Hull.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† Thurso	W. Dobson & Co.	740	—
† Kelso	Earle's S. & E. Co., Ltd.	730	—
† Nero	,, ,,	735	—
† Notre Dame des Dunes	Cochrane & Sons	724	—
† Canada	,, ,,	730	—
† Claudius	,, ,,	530	—
† Elite	,, ,,	710	—
† Lombard & Varanis	,, ,,	420ea	—
† Albatroz	,, ,,	530	—
† Lord Heneage	Cook, Welton & Gemmell, Ltd.	600	—
† Sir Jas. Reckitt	,, ,, ,,	590	—
† Leonate & Dogberry	,, ,, ,,	270ea	—
† Yorick	,, ,, ,,	280	—
† Steam Tug	Foreign	150	—
	Total	8,430	

Baird Bros., North Shields.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* Great Emperor		660	125
† Nyounghla		400	180
† Yenang Young		400	180
† Magwe		400	180
	Total	1,860	

Blair & Co., Ltd., Stockton-on-Tees.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
Tintern Abbey	Richardson, Duck & Co., Thornaby	1,150	—
Thessaly	,, ,, ,,	2,400	—
Cabo Sacritif	Euskalduna Co., Bilbao, Spain	1,150	—
Bismarck & Gladstone	Ropner & Sons, Ltd., Stockton	2,250ea	—
Errington Court	Northumberland S/B Co., Howden	2,550	—
Holtby	Ropner & Sons, Ltd., Stockton	1,950	—
Dalserf & Dalveen	Richardson, Duck & Co., Thornaby	1,250ea	—
Leversons	Robt. Thompson & Sons, Sunderland	1,300	—
Pikepool	Ropner & Sons, Ltd., Stockton	1,950	—
Karuma	Robt. Thompson & Sons, Sunderland	1,825	—
Rustington	Richardson, Duck & Co., Thornaby	1,800	—
	Total	23,075	

The Central Marine, West Hartlepool.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
Eretza Mendi	Bilbao	2,000	—
Bjornstjerne Bjornson	Bergen	2,500	—
Rossano	West Hartlepool	1,600	—
Harpeake	London	2,200	—
Caterino	West Hartlepool	1,600	—
Breynton	Cardiff	2,000	—
Hargrove	London	1,250	—
Rachel	London	1,900	—
		15,050	
	Other machinery	2,250	
	Total	17,300	

George Clark, Ltd., Sunderland.

S.S.'s Kingsgate, Pelica, Monkstone, Wm. Corry, Edenmore, Devereux. Total, 6 engines; total nominal horse-power by Lloyd's rules, 1,675. Total estimated indicated horse-power, 10,050.

A. B. Collis, Ltd., Bitterne Park, Southampton.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* Ada	A. B. Collis, Ltd.	35	130
* Steam Launch	,, ,,	20	120
* Do., Liquid Fuel	,, ,,	15	250
* 3 do., do.	Pickett, Southampton	35	250
4 Motor Launches from 16 to 28 ft.	A. B. Collis, Ltd.	—	—

Crabtree & Co., Ltd., Great Yarmouth.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* 2 Dredgers	Meyers Co., Holland	150	—
* 1 Drifter	Crabtree & Co., Ltd.	175	140
* 1 Tug	,, ,, ,,	100	120
* 1 Tug	G. Rennie & Co.	350	130
* 2 Drifters	H. Reynolds & Son	300	140
† 1 Drifter	,, ,,	180	180
* 3 Drifters	Fellows & Co., Ltd.	530	140
* 1 Drifter	Richards, Ltd.	100	140
* 1 Tug	Scarr & Son	300	120
* 4 Drifters		540	140
†	1 Engine exported	275	—
	18 Engines of total I.H.P.	3,120	

Great Central Co-operative Engineering and Ship Repairing Co., Ltd., Grimsby.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† H.M.S. Trawler Spider	Cochrane & Sons	460	180
† St. Trawler, Kong Fredrick III.	Cook, Welton & Gemmell	400	200
† St. Trawler, Minoru	,, ,, ,,	460	200
† ,, Cedar	,, ,, ,,	420	180
† ,, Gadra	,, ,, ,,	420	180
† ,, Gabir	,, ,, ,,	420	180
† ,, Consort	,, ,,	400	180
	Total	3,040	

† Triple. * Compound.

Davis & Co., Oulton Broad, Lowestoft.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* London County	Chambers & Son, Lowestoft	150	140

John Dickinson & Sons, Ltd., Sunderland.

S.S.'s Brinkburn, Tyninghame, South Atlantic, Hartside, Heatherside, Vosges, Oakmoor, Wakefield, Collingham. Total Lloyd's nominal horse power, 2,782. In addition to the above, they have built five extra boilers.

G. T. Grey, Holborn Engineering Works, South Shields.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
†*Skerne Cargo Steamer	Short Bros., Ltd.	550	—
Morien ,,	R. Thompson & Sons, Ltd.	900	—
* Wheatfield ,,	J. T. Eltringham & Co.	700	—
†*Shuna ,,	A. Vuijk & Sons, Holland	900	—
†*Breeze ,,	Van Vliet & Co., Holland	500	—
†*Woodmere ,,	Blyth Shipbuilding Co.	550	—
†*St. Lawrence, No. 1 Trawler	J. T. Eltringham & Co.	460	—
†*St. Louis, No. 1 ,,	,, ,,	460	—
	Total	5,020	

R. & W. Hawthorn, Leslie & Co., St. Peter's Works, Newcastle-on-Tyne.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
t H.M. 1st-class T.B., No. 33	British Admiralty	4,000	—
t H.M. 1st-class T.B., No. 34	,, ,,	4,000	—
t H.M.S. Zulu, T.B.D.	,, ,,	15,500	—
t H.M. unarmoured Cruiser Blanche	,, ,,	18,000	—
	Total	41,500	

Hepple & Co., Ltd., South Shields.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* Espadarte	Hepple & Co., Ltd.	200	120
* Titan	,, ,,	450	135
* Poodle	,, ,,	225	130
* Glenbrook	,, ,,	355	130
* Sir Joseph	,, ,,	180	110
p No. 600 (Dredger) (Oil Engine)	,, ,,	10	—
* Boyne Castle	The Dundee Shipbuilding Co.	320	140
	Total	1,740	

C. D. Holmes & Co., Ltd., Hull.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† Rose of England and Washington	Cochrane & Sons	450ea	180ea
† Scomber	,, ,,	520	180
† Haller	,, ,,	500	180
* Shotton	,, ,,	520	130
† St. Ives	Cook, Welton & Gemmell	540	200
† Rhilo and Rapio	,, ,,	375ea	180ea
† Calphurnia	,, ,,	475	180
† Seriema and Martineta	,, ,,	550ea	198ea
† Nemrod	,, ,,	450	180
	Total	6,055	

MacColl & Pollock, Ltd., Wreath Quay Engineering Works, Sunderland.

Name of Vessel.	Boilers	Builders.	I.H.P.	Press. lbs.
* Braeside	1 Boiler	John Crown & Sons, Ltd.	550	130
* Cairnside	1 ,,	,, ,,	550	130
† Uromi	2 ,,	W. Harkess & Son, Ltd.	1,000	160
† Ambiorix	2 ,,	Wm. Pickersgill & Sons, Ltd.	1,000	180
† Boduognat	2 ,,	,, ,, ,,	1,000	180
† The Roman	1 ,,	Smith's Dock Co., Ltd.	470	180
* Porthgain	1 ,,	,, ,,	450	130
* Mountcharles	1 ,,	,, ,,	450	130
		Total	5,500	

Additional boilers, 19.

Mersey Engine Works Co., Ltd., Liverpool.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
‡‡Onward, t.s. Steel Tug	Pimblott & Sons, Northwich	90	140
‡‡Rover, t.s. Steel Tug	,, ,,	135	120
‡‡Progress, Wooden Steam Tug	,, ,,	8	120
f Screw Steel Tug, No. 39	Mersey Engine Works, Sefton Street, Liverpool	25	120
‡‡15 ,,	,, ,,	25	120

Plenty & Sons, Ltd., Newbury, Berks.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* Unknown	British	150	120
* Unknown	Foreign	1,360	120
* ———	English	1,100	120
† ———	British	840	16

The Parsons Marine Steam Turbine Co., Ltd., Wallsend-on-Tyne.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
t Bahai (part machinery)	Sir W. G. Armstrong, Whitworth & Co., Ltd.		
t Rio Grande do Sul (part machinery)	,, ,,		
t H.M.S. St. Vincent	H.M. Dockyard, Portsmouth		
	Total		

* Compound. † Triple. *t* Turbine. *p* Petrol.
‡‡ Compound Surface Condensing. *f* Compound Non-Condensing.

North-Eastern Marine Engineering Co., Ltd., Wallsend and Sunderland.

Name of Vessel.	Builders.	I.H.P.	Press. lbs
Ashtree	Cardiff	1,085	—
Boverton	,,	1,850	—
Barmoor	Newcastle	1,375	—
Belgique	Antwerp	1,200	—
Boscawen	Cardiff	1,435	—
Benwood	Liverpool	2,050	—
Bromsgrove	Newcastle	2,045	—
Brugia & Bruxellia	Ghent	1,230ea	—
Conrad Mohr	Bergen	2,260	—
Constantine	Newcastle	1,085	—
Cacique (Quadruple)	London	3,150	—
Dania	Ghent	1,020	—
Danae	Caen	1,170	—
Espagne	Antwerp	900	—
Fiona	Sydney	2,420	—
Fernande	Caen	1,055	—
Gerania	Trieste	2,470	—
Germaine	Caen	1,055	—
Helga	Drammen	558	—
Himalaya	Trieste	2,470	—
Harlesden	London	2,375	—
Hebe	Caen	1,170	—
Ilaria	Trieste	840	—
Kaministiquia	Ontario, Canada	1,220	—
Kingswear	Dartmouth	1,100	—
Keywest & Keyport	Canada	648ea	—
Lancer	Newcastle	980	—
Lady Helen	Sunderland	830	—
Legia	Ghent	1,230	—
May Scott	Newcastle	1,085	—
Mars	Drammen	558	—
Magdalena	Terneuzen	1,200	—
Monitoria	Newcastle	1,180	—
Mapleton	Sunderland	935	—
Netherpark	Glasgow	2,200	—
Newona	Canada	1,220	—
Portugal	Antwerp	900	—
Protesilaus (twin screw)	Liverpool	6,000	—
Port Colborne	Canada	700	—
Paulina	Santander	1,480	—
Polvarth	Swansea	1,720	—
Queen Eugenie & Queen Maud	Glasgow	2,260ea	—
Querida	Bristol	870	—
Quickstep	Newcastle	1,045	—
Regis	London	1,020	—
Rochester City	Sunderland	935	—
Russia	Ghent	1,015	—
Relillio & Rubio	Newport	1,420ea	—
San Antonio	London	2,660	—
Steersman	,,	660	—
Tynemouth	Newcastle	1,375	—
The Stewart's Court	Sunderland	830	—
Therese	Caen	1,055	—
Vollrath Tham	Stockholm	2,020	—
		83,897	

Re-boilered.

Name of Vessel.	Builders.	I.H.P.	Press. lbs
Quaysider	Newcastle	295	—
Miguel Calmon	London	300	—
Wye	,,	996	—
	Total	85,488	

Richardsons, Westgarth & Co., Ltd., Hartlepool.

Name of Vessel.	I.H.P.	Press. lbs
S.S. Savannah	3,200	—
S.S. Teessider	2,150	—
S.S. Bassam	2,100	—
S.S. Feliciana	2,000	—
S.S.'s Shonga and Winneba	1,900ea	—
S.S.'s Appenine and Bendew	1,800ea	—
S.S. No. 486	1,800	—
S.S.'s Asiana & Armstor	1,600	—
S.S. Victor Hugo	1,400	—
S.S. Posteiro	1,300	—
S.S.'s Westgarth and Norge	1,200ea	—
S.S. Minister Delbeke	1,050	—
S.S.'s Axwel and Bondicar	1,000ea	—
S.S.'s Castor & Graceful	900ea	—
S.S. Broomhill	850	—
S.S. Webburn	800	—
S.S. Julie Lynn	750	—
S.S.'s Howden, Alfred Kreglinger, Togston and Harlingen	650ea	—
S.S. Retriever	600	—
S.S. Gladys	450	—
S.S. Breaksea	350	—
S.S. Scarsfos	250	—
	38,450	
Steam Turbines, Steam and Gas Engines, Marine and Water Tube Boilers	37,050	
Total	75,500	

Sisson & Co., Ltd., Gloucester.

Name of Vessel.	Builders.	I.H.P.	Press. lbs
‡‡Danube Launch, Napsugar	J. I. Thornycroft & Co., Ltd., Southampton	70	165
‡‡Launch for Rangoon	G. Rennie & Co., Greenwich, S.E. (sub-contractors to Sisson & Co.)	120	120
‡‡Not known, for Launch at Teneriffe	Not known	30	120

‡‡ Compound Surface Condensing.

The Shields Engineering and Dry Dock Co., Ltd., North Shields.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† Nunthorpe Hall		525	—
† Stella & Tyne Prince		425ea	—
† Sulby		575	—
† Dinas, Solva, Tamaye Maru		450ea	—
* Chira		280	—
* Janet Geddes, Lily and Maggie, Cluny Hill		245ea	—
* Marden		385	—
* Quaysider		560	—
† Dale Castle, Ilene Castle, Oku, Knaoki		525ea	—
	Total	7,360	

The Vauxhall & West Hydraulic Engineering Co., Ltd., Luton, Beds.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
‡‡Twin-screw Tug	British	195	120
‡‡Single-screw Tug	,,	400	130
‡‡2 S.S. Passenger Launches	,,	150ea	150ea
f Stern Wheeler	,,	40	40
‡‡2 Twin-screw Tugs	,,	350ea	350ea
‡‡2 Sets shipped abroad	Foreign	200	200
	Total	1,835	

The Wallsend Slipway and Engineering Co., Ltd., Wallsend-on-Tyne.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
Prince Rupert, T.S.	Swan, Hunter & Wigham Richardson, Ltd.	6,500	—
City of Colombo, S.S.	,, ,, ,,	3,450	—
British Sun and Patella	,, ,, ,,	2,800ea	—
Danubian	,, ,, ,,	2,700	—
t H.M.S. Newcastle	Sir W. G. Armstrong, Whitworth & Co., Ltd	22,000	—
c Minhla, S.S.	,, ,, ,,	900	—
2 Vessels	Foreign	1,600ea	—
c Lovrjenac & Lokrum	,,	1,200ea	—
Brisk, T.S.	R. & W. Hawthorn, Leslie & Co., Ltd.	1,050	—
Oceania, T.S.	Cantieri Ravali Nimiti	8,000	—
	Total	55,800	

W. & F. Wills, Ltd., Bridgwater.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* S. Eroder Pioneer, built in 1894 and re-engined in 1909	Hull by Clarke & Co., Brimscombe	55	160
	Engines and new eroding plant by W. & F. Wills, Ltd.	50	160

SCOTCH.

THE CLYDE, &c

Ailsa Shipbuilding Co., Ltd., Troon and Ayr.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† T.S.S. Itapuca & Itapema	Steel	Foreign	1,850ea	—	1,800ea
† S.S. Laverock	,,	British	1,450	—	1,500
† S.S. Sard	,,	,,	410	—	500
Nos. 220 & 221, Sailing Barges	,,	Foreign	210ea	—	—

Alley & MacLellan, Polmadie, Glasgow.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Yard No. 390	Steel	Foreign	—	130	—
391/4, 4 vessels	,,	British	—	2,000	—
395/6, 2 vessels	,,	,,	—	20	—
m 397	,,	,,	—	60	40
398/9, 2 vessels	,,	,,	—	60	—
400	,,	Foreign	—	100	—
* 403	,,	British	—	60	110

Ardrossan Dry Dock and Shipbuilding Co., Ltd., Ardrossan.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Nos. 231 & 232	Steel	—	160ea	—	—
† Ourimbah	,,	British	719	—	—
† No. 234	,,	—	425	—	—

Barclay, Curle & Co., Ltd., Whiteinch, Glasgow.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Pangan, Single S.		Foreign	3,550	—	2,100
Grantully Castle, Twin S.		British	7,800	—	4,600
Francis, Single S.		,,	3,900	—	2,500

William Beardmore & Co., Ltd., Naval Construction Works, Dalmuir.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
H.M.S. Gloucester	—	British	5,000dis.	—	22,000
T.S.S. Pharos	—	,,	1,000dis.	—	1,500

Bow, McLachlan & Co., Ltd., Paisley.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Piloto Sibbald & Contramaestra Ortiz, Screw	—	Foreign	296ea	—	—
2 Lighters	—	British	145ea	—	—
Scotia, Screw	—	,,	52	—	—

George Brown & Co., Greenock.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Lintil, Lighter	Steel	British	172	—	170
* Alyn, Coaster	,,	,,	350	—	450
* No. 54, Steam Launch	—	Foreign	30	—	125
* Dunceannen, Passenger and Cargo Steamer	Steel	British	142	—	280
† Cassiopea, Coaster	,,	Foreign	411	—	320
* Moy, Grab Dredger	,,	British	88	—	95

† Triple. * Compound ‡‡ Compound Surface Condensing. *f* Compound Non-Condensing *t* Turbine. *c* Single Cylinder. *m* Motor.

John Brown & Co., Ltd., Clydebank.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Golden Eagle, Paddle Str. .	—	British	794	—	2,700
Beagle, T.B. Destroyer ..	—	British Admiralty	920	—	12,500
Bulldog, ,, ...	—	,,	920	—	12,500
Foxhound, ,, ...	—	,,	920	—	12,500
Indefatigable, 1st-class Cruiser (Machinery only), Turbine	—	,,	—	—	45,000
Zealandia, T.S. steamer ..	—	British	6,600	—	6,000

Caird & Co., Ltd., Greenock.

a Mantua..	Steel	British	10,883	—	13,000

Campbeltown Shipbuilding Co., Campbeltown.

† Duva, Screw	Steel	British	1,201	1,300	—
† Astarte ,, ...	,,	,,	1,203	1,303	—

Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow.

Neva, S.S.	—	British	1,986	—	1,600
Luga, S.S.	—	,,	1,989	—	1,600
Swansea Vale, S.S.	—	,,	1,310	—	1,000
Parkmill, S.S.	—	,,	1,316	—	1,000
Mataram, S.S.	—	,,	3,273	—	2,500
South Africa, S.S.	—	,,	1,981	—	1,000
Luxemburg S.S.	—	,,	1,450	—	1,000
Ardgoil, machinery only ..	—	,,	—	—	2,100
Aspromonte ,, ...	—	Foreign	—	—	2,500
Kylemohr ,, ...	—	British	—	—	1,800

Charles Connell & Co., Ltd., Scotstoun.

Minderoo	—	British	2,719	—	2,450
Glencluny	—	,,	4,812	—	2,000
Dunedin	—	,,	4,796	—	2,000
Glenshiel	—	,,	4,798	—	2,000
Armadale	—	,,	4,771	—	3,000
Artist	—	,,	3,569	—	1,850

D. M. Cumming, Esq., Glasgow.

* St. Annes	Steel	British	20	—	130
10 Barges	,,	Foreign	90ea	—	—
p Barge	,,	,,	70	—	55B.H.P.

William Denny & Brothers, Leven Shipyard, Dumbarton.

Maori, T.B.D.	—	British	1,150	—	—
t Duke of Cumberland ..	—	,,	2,052	—	—
t Duke of Argyle	—	,,	2,052	—	—
Ruahine, T.S.S.	—	Colonial	10,758	—	—
Henzada, S.S.	—	British	5,521	—	—
Sir Trevredyn Wynne Paddle Train Ferry ..	—	,,	1,471	—	—
Vessels shipped in pieces ..			10,260	—	—

Robt. Duncan & Co., Ltd., Port Glasgow.

† Mariston, Screw	Steel	British	2,611	—	1,330
† Wilston	,,	,,	2,611	—	1,330

David J. Dunlop & Co., Inch Works, Port Glasgow.

† Sir George, Twin-screw ..	—	British	1,254	—	1,200

The Fairfield Shipbuilding and Engineering Co., Ltd., Govan, Glasgow.

t Bellona (Machinery only) ..	—	British			
Prinses Juliana	Steel	Foreign			
Oranje Nassau	,,	,,			
Mecklenburg	,,	,,	.. ..	27,655	93,500
t Grasshopper	,,	British			
t Glasgow	,,	,,			
Balmoral Castle	,,	,,			

Ferguson Brothers, Port Glasgow.

Heroine, Tug	—	Colonial	250	—	900
Don Federico, Dredger ..	—	Foreign	500	—	1,200
Crewe, Dredger	—	British	450	—	900
E, Hopper	—	,,	580	—	1,200
Mole, Dredger	—	,,	250	—	400
Crane Steamer	—	,,	450	—	500

Wm. Fife & Sons, Fairlie, Ayrshire.

Spero, Endrick & Vesania, Sail	—	British	ea 8	Thames Measurement.	—
Cintra, Sail	—	,,	20	—	—
Vanity ,, ...	—	,,	50	—	—
Chameleon, Aux. Motor Cutter	—	,,	28	—	14 B.H.P.
Tuiga, Sail	—	Foreign	50	—	—
Minoru, Aux Motor Cutter,	—	British	21	—	8 B.H.P.

Fleming & Ferguson, Ltd., Paisley, N.B.

† 3 Hopper Steamers	—	Foreign	—	800ea	600ea
† Viscount Ridley, Dredger ..	—	British	—	500	500
† Eilien Ward, Dredger ..	—	Colonial	—	1200,	2,000
† No. 387, Dredger	—	,,	—	500	1,500
† Hapai, Dredger	—	,,	—	1,000	1,200

John Fullerton & Co., Paisley, N.B.

† Endymion	Steel	British	887	1,187	780
* Maples & Alder	,,	,,	341ea	341ea	400ea
* Cardiff City	,,	,,	328	328	460
* Mudola	,,	Colonial	429	429	630
* Lord Beresford	,,	,,	112	112	300

Greenock and Grangemouth Dockyard Co., Ltd., Greenock.

† Mina Brea	Steel	British	4,145	—	2,350
† H. C. Henry	,,	,,	4,219	—	2,000
† Strathesk	,,	,,	4,336	—	2,250
† Strathdene	,,	,,	4,336	—	2,250
† San Francisco Xavier ..	,,	,,	340	—	800
† Caisson	,,	Foreign	150	—	—

a Quadruple. t Turbine p Petrol. † Triple. * Compound.

Wm. Hamilton & Co., Ltd., Port Glasgow.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Craster Hall	Steel	British	4,319	—	1,900
Caldergrove	,,	,,	4,327	—	2,050
Floating Dock	,,	Foreign	2,000 lifting power.		
Strathbeg	,,	British	4,338	—	2,050
Strathroy	,,	,,	4,336	—	2,050
Mercurius, Minerva, Stella..	,,	Foreign	2,841ea	—	1,500ea

David & William Henderson & Co., Partick, Glasgow.

Aberdonian, Steel Screw	—	—	1,648	—	3,150
Rowan ,, ..	—	—	1,544	—	4,250
Bellucia ,, ..	—	—	4,368	—	2,400
Motor Water Barge, Steel Screw	—	—	65	—	35

A. & J. Inglis, Ltd., Point House, N.B.

† Mercedes Laetoze	Steel	British	1,561	—	750

Lobnitz & Co., Ltd., Renfrew.

† Hydraulic Dredger with Robinson Cutter	—	Colonial	426	—	1,950
† Quorra, Sandpump Dredger	—	,,	432	—	2,000
Cygnus No. 12 Hopper Barge	—	British	265	—	—
* Hercules No. 7, Steam Hopper Barge..	—	,,	349	—	350
* Andre Rehoucas, Bucket Dredger	—	Foreign	496	—	1,100
Oriboco, Val de Caes, Paracury, Hopper Barges ..	—	,,	260ea	—	50ea
Three Hopper Barges ..	—	British	600	—	—
Five Gold Dredgers	—	—	575	—	450
Seven Rockcutters	—	—	582	—	1,040

London and Glasgow Engineering and Iron Shipbuilding Co., Ltd., Glasgow.

† Osterley	Steel	British	12,129	—	13,800

R. McAllister & Sons, Dumbarton.

Ostara	—	—	50	—	—
Javotte..	—	—	26	—	—
Correnzia	—	—	5	—	—
Apache	—	—	4	—	—
Armida	—	—	21	—	—
Minoru	—	—	9	—	—

Peter McGregor & Sons, Kirkintilloch, Glasgow.

‡‡No. 44	Steel	British	60	—	350
‡‡Kent Colebrooke	,,	,,	52	—	150
‡‡Rosyth No. 1	,,	,,	25	—	130
‡‡Maya	,,	,,	15	—	60
mEndrick	,,	,,	3	—	20

Archd McMillan & Son, Ltd., Dumbarton.

Aspromonte	Steel	Foreign	4,448	—	—
Strathalbyn	,,	British	4,331	—	—
Strathlorne	,,	,,	4,330	—	—
No. 428	,,	—	3,904	—	—
No. 430	,,	—	2,105	—	—
Sin-Mac	,,	British	328	—	—
J. O. Gravel	,,	,,	197	—	—

Mackie & Thompson, Ltd., Govan, Glasgow.

* Moray View, Drifter	—	British	93	—	280
* Magnificent III., Drifter ..	—	,,	94	—	250
* Bellavale, Cargo	—	,,	475	—	750
† Waimea, Cargo	—	Colonial	455	—	700
††Nikau, Cargo and Passenger	—	,,	248	—	400
† Wookata ,,	—	,,	648	—	700
††Kaitoa, Cargo	—	,,	304	—	500
* Elysian Dawn, and Eastern Dawn	—	British	91ea	—	280ea
† Baron Ruzette, Trawler ..	—	,,	226	—	480

A. Munro, Esq., Ardrishaig, Scotland.

mWater Lily, Lugger	—	British	18	—	15

Murdoch & Murray, Port Glasgow.

Jaminaua	—	Foreign	152	—	300
Minimbah		,,	455	—	700

Napier & Miller, Ltd., Old Kilpatrick.

† Baron Napier, S.S.	—	British	4,943	—	2,500
† Norman Monarch, S.S. ..	—	,,	4,997	—	2,300
† Five Islands, S.S	—	Colonial	941	—	870
* Lighter, S.S.	—	,,	195	—	270

John Reid & Co., Ltd., Whiteinch, Glasgow.

Warrawee, Screw Steamer .	Steel	Colonial	414	—	750

Ritchie, Graham & Milne, Whiteinch, N.B.

2 Cargo Barges	Steel	Foreign	ea 40	—	—
* Bolivar, Twin-screw .. .	—	,,	100	—	320
* Steam Launch, Single screw	—	,,	25	—	42
4 Pontoons	Steel	,,	20	—	—
* Neptuno, Single screw ..	—	,,	50	—	140
3 Cargo Barges	Steel	,,	240	—	
* Steam Launch	Steel	Crown Agents	6	—	16

A. Robertson & Co., Sandbank, Argyllshire.

Novena, Racing Sloop ..	—	Foreign	3	—	
Grace ,, ..	—	British	7	—	
Cyra, Racing Cutter	—	,,	27		—
Joan, Bucket Dredger ..		,,	12	—	—

A. Rodger & Co., Port Glasgow.

Baron Ogilvy, two-deck Steamer	—	British	4,570		2,500
Benbridge, single-deck Str.	—	,,	3,100		1,900
Magallanes & Chiloe, two-deck Passenger Steamers	—	Foreign	1,530ea	.	1,500ea

m Motor. * Compound. † Triple. †† Twin Compound.
‡‡ Compound Surface Condensing.

Russell & Co., Port Glasgow.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Highland Rover and Highland Pride (Pass. & Cargo Steamers refrigerated) ..	—	British	7,244 ea.	—	—
Madura (Spar-deck Cargo Steamer)	—	,,	5,500	—	—
Ardgryfe (Spar-deck Cargo Steamer)	—	,,	4,897	—	—
Kirkdale (Spar-deck Cargo Steamer)	—	,,	4,731	—	—
Mineric (Shelter-deck Cargo Steamer)	—	,,	4,713	—	—
Earl of Elgin (Spar-deck Cargo Steamer)	—	,,	4,448	—	—
Ardgoil (Spar-deck Cargo Steamer)	—	,,	4,395	—	—
Bassano (Spar-deck Cargo Steamer)	—	,,	4,295	—	—
Bright Wings (Single-deck Cargo Steamer)	—	,,	3,116	—	—
Kylemhor (Single-deck Cargo Steamer)	—	,,	3,046	—	—
Luabo (Twin-screw Passenger and Cargo Steamer) ..	—	Foreign	1,385	—	—
Aungthain and Aungtad (River Passenger Steamers)	—	British	250ea	—	—

Scott & Sons, Bowling, nr. Glasgow.

* J. & J. Monks	Steel	British	283	—	520
* No. 214	,,	,,	90	—	330
* Buteman	,,	,,	468	—	600
* Dirk	,,	,,	181	—	525

Scotts' Shipbuilding and Engineering Co., Ltd., Greenock.

Gleneden, screw steamer ..	Steel	—	4,734	—	2,800
Glenorchy ,, ..	,,	—	4,736	—	2,800
Beachy ,, ..	,,	—	4,718	—	2,800
Hurst ,, ..	,,	—	4,718	—	2,800
Carrou ,, ..	,,	—	2,351	—	3,250
H.M. Battleship St. Vincent, machinery with Babcock and Wilcox boilers ..	,,	—	—	—	24,500
					38,950

Wm. Simons & Co., Ltd., Renfrew.

2 Service Steamers	—	Foreign	860ea	—	980ea
Dredger	—	Colonial	2,061	—	3,300
Dredger	—	Foreign	40	—	175
Dredger	—	British	201	—	550
Dredger	—	Foreign	290	—	900
Dredger	—	Colonial	558	—	1,350
2 Hopper Barges	—	Foreign	450ea	—	—
Dredger	—	Colonial	—	—	400
Machinery	—	British	—	—	450
,, ...	—	Foreign	—	—	400
Pontoons	—	Colonial	100	—	—
					9,485

Alexander Stephen & Son, Ltd., Linthouse, Glasgow.

† Hollandia (Screw)	Steel	Foreign	—	7,291	—
† Tortuguero (Screw)	,,	British	—	4,161	—
† Romera (Screw)	,,	,,	—	4,948	—
† Masunda (Screw)	,,	,,	—	4,952	—

Yarrow & Co., Ltd., Glasgow.

Rio Grande do Norte, Parahyba, Alagôas, Santa Catharina, 4 Torpedo-boat Destroyers, 240 ft. long by 23 ft. 6 in. beam, speed 27 knots	—	Foreign	560ea	—	8,000ea
Boiler and Engines for Shallow Draught Steamer	—	,,	—	—	1,000
Boilers (5) for Torpedo-boat Destroyer Rattlesnake ..	—	British	—	—	12,500
Winchester, Turbine Yacht, 165 ft. long by 15 ft. 6 in. beam, speed 26½ knots ..	—	Foreign	174	—	2,500
2 Sets of Internal Combustion engines for 2 Motor Gunboats, 350 H.P. each set	—	,,	—	—	700
Velda, Twin-Screw Shallow Draught Tug, 85 ft. by 16 ft.	—	Foreign	84	—	180
Flecha, Zagaia, 2 Shallow Draught Gunboats, 70 ft. long by 13 ft. beam ..	—	Foreign	36ea	—	50ea
2 Torpedo-boat Destroyers, 230 ft. long by 21 ft. 6 in. beam..	—	Dutch Govt.	465ea	—	7,500ea
Shallow Draught Launch, 75 ft. long by 10 ft. 6 in. beam..	—	Foreign	22	—	70

THE FORTH, &c.

John Cran & Co., Leith, N.B.

Name of Vessel.	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* S.S. Herculaneum	Steel	British	173	—	780
* S.S. No. 69	,,	,,	35	—	70
2 Steel Barges	,,	Colonial	50dis	—	—

*Compound. † Triple.

The Greenock & Grangemouth Dockyard Co., Ltd., Grangemouth.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Netravati ..	Steel	British	1,537	—	2,500
† Burringbar	,,	Colonial	876	—	1,800
* Fausto Cosulich	..	Foreign	378	—	350
		Total ..	2,791		4,650

Hawthorns & Co., Limited, Leith.

Incheolm, Coaster	—	British	97	—	90

Ramage & Ferguson, Ltd., Leith.

† Oder	Steel	British	964	—	1,000
† Alster	,,	,,	964	—	1,000
† Slemish	,,	,,	1,536	—	1,150
† Argus	,,	,,	653	—	1,000

J. Weatherhead, Eyemouth.

Mascot, Tug	Wood	Bristol	abt8	—	—
Welcome, Tug	,,	,,	abt8	—	—

THE TAY.

The Caledon Shipbuilding and Engineering Co., Ltd., Dundee.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* King Herring	Steel	British	100	100	250
† Ardmore	,,	,,	1,304	1,304	1,250
† Cupid	,,	,,	611	611	570
† Norna	,,	—	457	457	950
† Aguila	,,	,,	2,114	2,114	1,750
† Gowrie	,,	,,	1,031	1,175	1,450
† Princess Caroline	,,	,,	1,050	1,410	1,250

Dundee Shipbuilding Co., Ltd., Dundee.

† Julie Lynn ..	Steel	Foreign	690	—	480
* Boyne Castle	,,	British	245	—	320
† Zena Dare	,,	,,	242	—	420
† Athalia	,,	,,	230	—	430

The Montrose Shipbuilding Co., Montrose.

* Inchbrayock		British	400	—	400
* Miown		,,	450	—	350
* Netta		,,	450	—	350

THE DEE.

The John Duthie Torry Shipbuilding Co., Aberdeen.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Kincorth Steam Liner ..	—	British	149	—	320
Isco III. Steam Lighter ..	—	,,	13	—	20
Ardlaw & Craigbo, Steam Drifters	—	,,	94ea	—	240ea
G.M.B., Steam Drifter ..	—	,,	94	—	220
Elsie, Steam Trawler	—	,,	250	—	420
Falmouth ,, ...	—	,,	198	—	350

Alexander Hall & Co., Ltd., Aberdeen.

Ann Melville, Trawler ..		British	201	—	415
Fairview ,, ..	—	,,	187	—	375
Granuweal ,, ..	—	,,	174	—	375
Covesea, Drifter	—	,,	87	—	235
Regent Bird & Beryl II., Drifters	—	,,	88ea	—	235ea

Hall, Russell & Co., Ltd., Aberdeen.

Cinco, S. Trawler	—	Foreign	181	—	420
Richard Irvin, S. Trawler	—	,,	197	—	450
Vale of Lennox, S. Trawler	—	,,	233	—	480
Fair Isle, S. Trawler	—	,,	192	—	420
John E. Lewis, S. Trawler ..	—	,,	254	—	—
Glen Tanar, S. Cargo ..	—	,,	817	—	800
Loch Shiel & Loch Awe, S. Trawlers	—	,,	216ea	—	450ea
John H. Irvin, S. Trawler ..	—	,,	197	—	450
Newhaven N.B., S. Trawler	—	,,	182	—	400
Ferryhill, S. Cargo	—	British	411	—	480
Pelaw Main, T.S. Cargo ..	—	Colonial	1,222	—	1,600
Craigewan, S. Trawler ..	—	British	202	—	450

LIST OF VESSELS ENGINED IN 1909.

J. Abernethy & Co., Aberdeen.

Name of Vessel.	Builders of Vessel.	I.H.P.	Press. lbs.
† Kincorth	J. Duthie Torry S.B. Co., Aberdeen	300	160
† Craig-Bo	,, ,,	260	180
* Ardlau	,, ,,	240	150
* G. M. B.	,, ,,	220	150
	Total ..	1,020	

Aitchison Blair, Ltd., Clyde Bank, N.B.

* Single Screw	Foreign	160	140
* ,, ,, ...	,, ...	550	120
* ,, ,, ...	,, ...	110	130
* ,, ,, ...	,, ...	150	120
† ,, ,, ...	,, ...	600	180
* Twin ,, ...	,, ...	340	145
	Total ..	1,910	

† Triple. * Compound.

Campbell & Calderwood, Paisley.

Name of Vessel.	Builders.		I.H.P.	Press. lbs.
17 Sets of Screw Engines	Foreign		1,400	—
2 „ Stern Wheel Engines	„		200	—
4 „ Paddle „	„		700	—
23		Total ..	2,300	

Cooper & Greig, Dundee.

† S.S. Tay and Tyne	Dundee Shipbuilding Co., Ltd.	800	
* One Set Engines	.. ..	200	—

J. Cran & Co., Leith.

* S.S. Herculaneum	John Cran & Co.	780	120
* S.S. No. 69	„ „	70	120

Barclay, Curle & Co., Ltd., Whiteinch, Glasgow.

Ravenswood, Paddle Steamer	—		1,300	—
2 Vessels, Single-Screw	—	1,650 ea	3,300	—
Engines of 3 Vessels launched in addition	—		9,200	—
		Total ..	13,800	

Denny & Co., Dumbarton.

t H.M.S. Maori	British Admiralty	—	—
t Duke of Cumberland	Channel	—	—
t Duke of Argyll	„	—	—
† Henzada	Eastern	—	—
† Ruahine	Colonial	—	—

Also a number of Sets of Paddle Wheel and Twin-screw Machinery for Steamers, Launches and Tugs built abroad.
Total I.H.P., 71,750.

Dunsmuir & Jackson, Ltd., Glasgow.

† Netravati	Greenock & Grangemouth Dockyard Co., Ltd.	2,500	—
† Minderoo	Chas. Connell & Co., Ltd.	2,700	—
† Glencluny, Dunedin, Glenshiel	„ „ „	2,500ea	—
† Artist	„ „ „	2,000	—
† Baron Napier, Norman Monarch	Napier & Miller, Ltd.	2,500ea	—
† Burringbar	Greenock & Grangemouth Dockyard Co., Ltd.	1,800	—
	Total ..	21,500	

Fishers, Ltd., Paisley.

‡‡Kent Colebrooke	P. McGregor & Sons, Kirkintilloch	140	130
‡‡Rosyth	„ „ „	140	120
‡‡Maple and Alder	J. Fullerton & Co., Paisley	400ea	130ea
‡‡2 Vessels, names not known	Dublin Dockyard Co.	50ea	90ea
‡ 2 Vessels, names not known	„ „	40ea	90ea
† Name not known	Scott & Sons, Bowling	380	160
	Total ..	1,640	

Gauldie, Gillespie & Co., Kinning Park, Glasgow.
Seven sets Marine Engines with a total I.H.P. 1,725.

John G. Kincaid & Co., Ltd., Clyde Foundry, Greenock.

† Mina Brea, Single-Screw Oil Tank Steamer	Greenock & Grangemouth Dockyard Co., Limited (Greenock)	2,350	—
† Strathesk, Single-Screw Cargo Steamer	„ „ „	2,250	—
† Strathalbyn and Strathlorne, Single-Screw Cargo Steamers	A. McMillan & Sons, Ltd., Dumbarton	2,250ea	—
† Bright Wings, Single-Screw Cargo Steamer	Russell & Co., Port Glasgow	1,650	—
† Luabo, Twin-screw Passenger and Cargo Steamer	„ „ „	1,000	—
* Jaminaua, Single-Screw Passenger and Cargo Steamer	Murdoch & Murray, Port Glasgow	300	—

W. V. V. Lidgerwood, Whifflet, Coatbridge.

† Zena Dare and Athalia	Dundee Shipbuilding Co.	480ea	180ea
* Moray View and Magnificent III.	Mackie & Thomson, Ltd., Govan	280ea	140ea
* Elysian Dawn and Eastern Dawn	„ „ „	280ea	150ea
† Baron Ruzette	„ „ „	480	180
† Elsie	The J. Duthie Torry Shipbuilding Co., Aberdeen	480	180
† Falmouth	„ „ „	400	180
* Inchbrayock	Montrose Shipbuilding Co.	480	130
* Barge	.. ..	220	140
11 Sets.	Total ..	4,140	

Messrs. McKie & Baxter, Glasgow, have turned out marine machinery totalling 7,895 I.H.P.

Menzies & Co., Ltd., Leith.

* 2 Vessels	MacKay Bros., Alloa	250ea	130ea

t Turbine. * Compound. † Triple. ‡ High Pressure.
‡‡ Compound Surface Condensing.

Miller & Macfie, Ltd., Glasgow.

Name of Vessel.	Builders.	I.H.P.	Press lbs.
‡‡For shipment	Napier & Miller, Ltd., Old Kilpatrick	270	120
‡‡S.S. Dunster Castle	Garston Shipbuilding Co., Liverpool	270	130
‡‡S.S. Moy	George Brown & Co., Greenock	95	120
‡‡For Shipment	India	60	120

S. & H. Morton & Co., Victoria Dock, Leith.

* S.S. Fausto Cosulich	Greenock & Grangemouth Dockyard Co., Ltd., Grangemouth	350	—

Muir & Houston, Ltd., Kinning Park, Glasgow.

* Warrawee	John Reid & Co., Ltd., Whiteinch	750	130
* Sard	Ailsa Shipbuilding Co., Ltd., Ayr	600	130
† Wookata	Mackie & Thomson, Ltd., Govan	700	180
† No. 430 and Sin-Mac	Archd. McMillan & Son, Ltd., Dumbarton	1,100ea	185ea
† San Francesco Xavier	Greenock & Grangemouth Dockyard Co., Ltd., Greenock	800	180
	Total ..	4,950	

Rankine & Blackmore, Greenock.

† Ardgryfe and Minerie	Russell & Co.	2,700ea	180ea
† Earl of Elgin	„	2,500	180
† Valdura	„	3,100	180
† Highland Rover	„	5,000	210
† Highland Pride	„	5,000	210
	Total ..	21,000	

Renfrew Bros. & Co., Irvine, Ayrshire.

* S.S. J. O. Gravel	A. MacMillan & Son, Dumbarton	630	130
† S.S. Ourimbah	The Ardrossan Shipbuilding Co., Ltd., Ardrossan	700	180

James Ritchie, Partick.—Three small sets of compound surface condensing engines for shipment abroad, delivered and one set engines for tug steamer in hand.

A. Rodger & Co., Govan.

† Benbridge	A. Rodger & Co., Port Glasgow	1,900	—
† Magallanes and Chiloe	„ „ „	1,500ea	—
	Total	4,900	

Ross & Duncan, Glasgow, have turned out thirty-seven sets of marine engines of 12,700 horse power. Of these, fourteen sets of 8450 horse power were fitted in the following vessels :—S.S. Buteman, S.S. Cardiff City, S.S. Dirk, S.S. Endymion, T.S.S. Kaitoa, T.S.S. Kairaki, T.S.S. Lord Stalbridge, S.S. Lord Beresford, S.S. J. & J. Monks, T.S.S. Nikau, S.S. Petriana, S.S. Undola, T.S.S. Waimea, and S.S. No. 212; and twenty-three sets of 4,250 horse power were shipped abroad. In addition to boilers for the above engines, thirteen boilers of 3,500 horse power were constructed during the year.

David Rowan & Co., Glasgow.

Albatross	Greenock & Grangemouth Dockyard Co., Ltd.	520	—
Victoria de Larrinaga	Russell & Co.	2,800	—
Craster Hall	Wm. Hamilton & Co., Ltd.	2,500	—
Astarte and Duva	Campbeltown Shipbuilding Co.	1,000ea	—
Mariston and Wilston	Robert Duncan & Co., Ltd.	1,400ea	—
Caldergrove	Wm. Hamilton & Co., Ltd.	2,250	—
Baron Ogilvy	A. Rodger & Co.	2,300	—
H. C. Henry	G. & G. Dockyard Co., Ltd.	2,600	—
Five Islands	Napier & Miller, Ltd.	900	—
Strathbeg & Strathroy	Wm. Hamilton & Co., Ltd.	2,250ea	—
Bassano	Russell & Co.	2,300	—
Armadale	Chas. Connell & Co.	3,400	—
504	Arch. McMillan & Son, Ltd.	2,000	—
Mercurius, Minerva, and Stella	Wm. Hamilton & Co., Ltd.	1,700ea	—
Kirkdale	Russell & Co.	3,000	—
Minimbah	Murdoch & Murray	600	—
Strathdene	G. & G. Dockyard Co., Ltd.	2,250	—
	Total ..	41,820	

Also 25 Boilers for shipment, Total 12,000 I.H.P.

IRISH.

Dublin Dockyard Co., North Wall, Dublin.

Name of Vessel.	Built of	Owners	G.T. Regis.	G.T. incln. erect.	I.H.P.
† T.S.S. Kairaki	Steel	Colonial	403	403	650
* S.S. Balmel II.	„	British	620	620	950
1 Barge, No. 67		„	60	60	—
* T.S.S. Lord Stalbridge	Steel	„	168	175	675
* T.S. Coaling Steamer Herald (Patent)	„	„	101	101	75

Harland & Wolff, Ltd., Belfast.

a Leicestershire, Screw	Steel	British	8,040	—	5,100
t Karoola, Screw	„	Colonial	7,391	—	7,000
a Meltonian, Screw		British	6,306	—	3,150
a Mallina, Screw		Colonial	3,213		3,240
a Berbice, Screw		British	2,379	—	1,380
a Balantia, Screw		„	2,379		1,380
t Neptune, battleship for H.M. Navy	hull built at Portsmouth				25,000

a Quadruple. *t* Turbine. * Compound. † Triple.
‡‡ Compound Surface Condensing.

The Larne Shipbuilding Co., Larne Harbour, Ireland.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
8 Tow Barges, Cromac, Falls, Ormeau, Pottinger, Shankill, Smithfield, Victoria, Windsor	Steel	British	50ea	—	—

Workman, Clark & Co., Ltd., Belfast.

Name of Vessel.		Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Bahia	Steam	Steel	Foreign	3,500	—	3,500
Minas Geraes	,,	,,	,,	3,700	—	3,500
Bocaina	,,	,,	,,	1,695	—	1,200
Pyreneu	,,	,,	,,	1,696	—	1,200
Otranto	,,	,,	British	12,124	—	14,400
Orvieto	,,	,,	,,	12,130	—	14,400
Abangarez	,,	,,	,,	4,955	—	3,800
Turrialba	,,	,,	,,	4,961	—	3,800
Atenas	,,	,,	,,	4,962	—	3,800
Star of Canada ..	,,	,,	,,	7,280	—	4,500
Almirante	,,	,,	,,	5,010	—	3,800
Santa Marta	,,	,,	,,	5,013	—	3,800
Metapan	,,	,,	,,	5,013	—	3,800
Zacapa	,,	,,	,,	5,013	—	3,800
Professor	,,	,,	,,	3,700	—	1,750
Rangatira	,,	,,	,,	8,200	—	5,500

All vessels engined by Workman, Clark & Co. Ltd.

LIST OF VESSELS ENGINED IN 1909.

MacColl & Co., Ltd., Abercorn Basin, Belfast.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* Balniel II.	Dublin Dockyard Co.	950	140

FRENCH.

Baheux Bros., Boulogne-Sur-Mer.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Immaculée Conception, sailing drifter	Wood	Boulogne	97	—	—
* Emile Marie, steam trawler	Steel	,,	95	—	200
Rose Mysterieuse, sailing drifter	Wood	,,	97	—	—
Forges et Chantiers de France, Dunkirk.					
† Saint Eloi	—	Dunkirk	1,993	—	—
* Chevigne	—	Dakar	163	—	—
† Niemen	—	Bordeaux	1,888	—	—
† Saint Jacques and Saint Thomas	—	Havre	2,460ea	—	—
† Sybil and Antoine	—	Bayonne	2,390ea	—	—
† 3 T.S. Steamers, Nos. 61, 62, 63, Bosphorus	—	Constantinople	520ea	—	—
Maurel freres, Bordeaux.					
† Niemen, Reg. at Lloyd's ..	—	Bordeaux	1825	2,100	1,200
A. Normand et Cie, Le Havre.					
t Chasseur, torpedo-boat destroyer	—	—	—	—	7,200
Schneider & Co., Creusot.					
t S.T.	—	—	455T (tonnage total)	—	8,000
Societe Anon des Chantiers et Ateliers de Normandie, Grand Quevilly, Rouen.					
† Honduras Cargo Boat ..	Steel	Havre	5,900	—	2,400
Societe Anonyme des Chantiers de St. Nazaire, Penhoet.					
† Paul Leterme, for laying buoys	—	—	310	—	425
* Diderot, Battleship	—	—	18,500dis	—	22,500
Societe Anon des Forges et Chantiers de la Mediterranee, Toulon.					
t Voltaire (Battle-ship)	Steel	French Navy	11,223	—	22,500ch
Atlas (Pontoon-Sheers) ..	,,	La Seyne	200	—	To lift 150T
4 Coal Barges	,,	French Navy	131	—	—
Rio Grande do Sul, Launch	,,	Rio Grande do Sul	37·33	—	190ch
Societe Anon des Chantiers et Ateliers de Provence, Port de Bouc.					
† Basse-Terre	—	Le Havre	4,400	—	1,800
† Espagne	—	,,	13,000	—	14,000

LIST OF VESSELS ENGINED IN 1909.

Schneider & Co., Creusot.

Name of Vessel.	Builders.	I.H.P.	Press. kgs.
t S.T.	—	8,000	—
Edgar Quinet	—	36,000	—
J. & A. Niclausse, Paris.			
Ernest Renan	..St. des Chantiers and Ateliers de St. Nazaire (Penhoet)	36,000	21
Waldeck-Rousseau	Port de Lorient	36,000	21
Comdorcet ..	..Société des Forges et Chantiers de la Loire	23,000	18
Diderot ..	..Societe des Chantiers et Ateliers de St. Nazaire	23,000	18
Vergniaud ..	..Societe des Chantiers et Ateliers de la Gironde	23,000	18

All fitted with Niclausse Boilers.

† Triple. * Compound. *t* Turbine.

BELGIAN.

Antwerp Engineering Co., Antwerp.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Espagne, 2 masted F. & A. Schooner	Steel	Antwerp	1,462	—	850
† Portugal, ,,	,,	,,	1,462	—	850
† Mars, ,,	,,	Drammen	715	—	570
† Helga, ,,	,,	,,	715	—	570

Work taken over from Chantiers Navals Anversois.

Aug. Hamman, Ostend.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Pêcheries Heystoises I. and II. (Trawlers)	—	Heyst-on-Sea	—	ab30ea	
Le Progrès (Lobster Carrier)	—	Ostend	—	—	—
Hélène (Fishing Trawler)	—	,,	ab50	—	—
5 Trawlers	—	—	ab30ea	—	—
Societe Anon. John Cockerill, Hoboken.					
† Princesse Marie-José, Cargo Boat	Steel	Antwerp	2,460	—	1,550
m Piannier II., Trawler ..	,,	Ostend	101	—	30
p Pasteur II. and Reclame, Barges	,,	Belgium	110ea	—	—
‡ 485, Screw Tug with sails ..	,,	Congo	13	—	30
‡ 486, Stern Wheel	,,	,,	58	—	125
a Perseverance and Resistance Tugs	,,	Liege	100ea	—	250ea
† Police de la Rade, screw st.	,,	Antwerp	100	—	230
p Vedette I. and II., Ferry Motors	,,	Ostend	8 & 10 res.	—	35ea
† His VI. Trawler	,,	,,	180	—	400
‡ Est du Kwango (screw) ..	,,	Congo	9	—	20
p 495, Motor Boat	,,	Brazil	3	—	11
† Gaby, Trawler	,,	Ostend	180	—	400
p 498, Ferry Motor	,,	Flushing	14	—	65
CDXVII.—VIII.—CDXXI.—II.(4 Cargo Boats) ..	,,	Rio Grande do Sul	513ea	—	—
4 Barges	,,	Belgium	110ea	—	—
6 Hopper Punts	,,	Rio Grande do Sul	210ea	—	—

GERMAN.

Blohm & Voss, Hamburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Prinzess Eitel Friedrich (Training Ship)	Steel	Oldenburg	about 1,600		—

Von der Tann, large Cruiser for the German Navy.

Heinrich Brandenburg, Hamburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
No. 228, Barge	Steel	Hamburg	—	50	—
No. 243, ,, ...	,,	,,	—	20	—
Bremer Vulcan Schiffbau und Maschinenfabrik, Vegesack.					
a Cezw. Baunummer, SS. 510	Steel	—	6,742	—	3,250
† Clara Blumenfeld	,,	Hamburg	2,331	—	1,400
* SS. 522	,,		136	—	70
m ,, 523	,,	Vegesack	—	—	—
* Anna	,,	Brazil	711	—	580
* Hafenfahre I. and II. ..	,,	Bremerhaven	35ea	—	5ea
† Toreador	,,	Bremen	1,350	—	750
* August Peters	,,	Hamburg	65	—	250
† Reiher	,,	Bremen	1,045	—	1,000
* Argo	,,	,,	68	—	230
* Answald	,,	,,	5,330	—	2,600
† Adeline—Hugo Stinnes, 3 ..	,,	Mulheim-Rulve	2,700	—	1,700
Eiderwerft Actiengesellschaft, Tonning.					
† Liselotte Linnemann	Steel	Harburg	—	703	400
† Arngast	,,	—	—	—	500

3 Lighters, 1 Cinder Barge, 3 Mud Barges, 1 Lightship.

Flensburger Schiffsbau Gesellschaft.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
No. 283, Dock	Steel	Stettin	2,020	—	—
No. 284, ,, ...	,,	,,	2,700	—	—
No. 285, ,, ...	,,	,,	5,180	—	—
Buffalo	,,	Hamburg	6,632	—	3,000
John Heidmann	,,	,,	2,380	—	1,300
Imkenturm	,,	Bremen	5,004	—	2,250
Minister Helleputte	,,	Antwerp	2,184	—	850
No. 292	,,	,,	1,100	—	650
Gluckauf	,,	Flensburg	2,250	—	1,100
No. 294	,,	Hamburg	1,050	—	575
Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden.					
Coln, Cruiser	Steel	Kiel	4,350dis	—	20,000
G 169-73 (Torp.)	,,	,,	dis 650ea	—	12,000
Pontoon for Floating Crane	,,	,,	—	—	—
Meteor, Schooner	,,	,,	gr. reg. t.197	—	—
Henry Kock Shipbuilding Yard, Lubeck, Germany.					
† Rheingraf	Steel	Hamburg	1,769	2,275	900
6 Barges (65 T. each) ..	,,	Lubeck	390	—	—
* Tugboat	,,		ab50	—	90
I. G. Hitzler, Lauenburg (Elbe).					
m S. 222, Electric Ship's Crane	Steel	—	—	800	23
m S. 223, 225, 229, Motorboats	,,	—	—	—	17
S. 220, Lighter	,,	—	—	210	—
† S. 224, 226 and 227 Tugboats	,,	—	—	—	350

† Triple. *m* Motor. *p* Petrol. ‡ High Pressure. *a* Quadruple. * Compound.

R. Holtz, Harburg (Elbe).

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
7 Steamboats	Steel	Foreign	—	100	321
3 „	Wood	„	—	39	148
1 Motorboat	„	German	—	18	10eff
9 „	Steel	Foreign	—	80	127 „
13 Lighters	„	„	—	179	—
4 Lifeboats	„	„	—	—	—

Howaldtswerke, Kiel.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
No. 498, Floating Crane	Steel	Kiel	—	1,350	300
No. 501, 3 Pontoons	„	„	—	125ea	—
No. 509, Salvage Floating Dock	„	„	—	800	40
m No. 510, Iskra	„	Krakau	—	10	35
m No. 512, Bolinder VIII.	„	Kiel	—	40	100
No. 515, Hopper Barge	„	„	—	180	—
No. 516, „	„	„	—	180	—

Johannsen & Co., Danziger Schiffwerft, Danzig.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Floating Crane	Steel	Danzig	—	—	60

J. W. Klawitter, Danzig, Germany

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
No. 342	Steel	Kiel	65	—	—
* Wobnitz	„	Stettin	48	—	200
No. 344	„	Danzig	200	—	—
* Vistula	„	„	160	—	230
† Wilhelms, Buoy-layer	„	Stolfwünde	159	179	500
† Karl	„	Fürstenberg a/Oder	100	—	250

C. Luhring, Brake.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Theodor, Three Masted Schooner	Steel	Brake	—	200	—
Regina, Maria, Erna, Alma, Two Masted Schooners	„	—	—	120ea	—
No. 96, Motor boat	—	—	—	—	—

Gebr. Maass, Neustrelitz, Meckenburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Carl Wilhelm	Steel	—	48	—	140
† Siegesfürst	„	—	77	—	220
* Elisabeth	„	—	60	—	140
† Falke	„	—	54	—	180-200

J. L. Meyer, Papenberg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Gerrit Wessels	Steel	Emden	—	—	200
* C.8 and C.1, W.5, C.2, C.9	„	—	—	62ea	155ea
Yard No. 238	„	—	—	300	—
m „ 239	„	—	—	23	50
* Prinz Heinrich	„	Emden	—	—	300
* Yard No. 241	„	—	—	7	20
„ P. 62/63	„	—	—	114	—

"Neptun" Actien. Ges., Rostock.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Halmstad, Steam	Steel	Altona	—	814	700
† Alexandra „	„	Lubeck	—	1,123	1,000
† Lissabon „	„	Hamburg	—	2,781	1,100
† Gretchen Muller, Steam	„	„	—	1,421	900
† Capri and Tunis „	„	„	—	1,525ea	1,000ea
Hermine, Sailing	„	—	—	100	—
Sturmwozel II.	„	Hamburg	—	140	—
m Lismona II., Yacht	„	Rostock	—	37	22
Skeaf, Yacht	„	Schleswig	—	—	—
m Gudrun Motorboat	„	Ribnitz	—	29	40
m Ursula, Motorboat	„	Rostock	—	—	24
No. 287, Pontoon	„	„	—	—	—
No. 292, Lighter	„	Schleswig	—	130	—

Reiherstieg Schiffswertt und Maschinentabrik, Hamburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Marineverwaltung No. XII	Steel	Hamburg	—	—	50
† Tserlohn, Schooner	„	„	—	4,667	3,000
* Sanaga	„	„	—	—	60

Rickmers Reismuhlen, Rhederei & Schiffbau A. G., Bremerhaven.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Sabine Rickmers	Steel	Bremerhaven	4,105	—	1,600
Etha Rickmers	„	„	4,101	—	1,600
Mai Rickmers	„	„	4,104	—	1,600

Gebr. Sachsenberg, Rosslau-on-Elbe.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Preussen	Iron	Halle a. S.	40	—	50
† Ver. Frankfurter Reedereien X.	„	Homberg	660	—	1,100
† Kronprinzessin Cecilie	„	Breslau	340	—	600
† Franz Haniel XIV.	„	Ruhrort	675	—	1,280
* Würtemberg, Baden, Hessen	„	Dresden	370ea	—	500ea
* Siegfried	„	Halle a. S.	75	—	100
† Mathias Stinnes, No. 22	„	Mulheim a. d. Ruhr	690	—	1,300
† Wittenberge	„	Hamburg	253	—	320
* Kronprinzessin Cecilie	„	Boppard	150	—	250
* Maria Juanita	„	Bolivia	15	—	35
Reinhard Franz	„	Uerdingen	106	—	—

F. Schichau Schiffswertt zu Danzig, Danzig.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Orel and Poltawa	Steel	Vladivostock	—	3,424ea	4,300ea
Rjasan	„	„	—	3,433	4,300
Simbirsk	„	„	—	2,045	4,000
Pensa	„	„	—	2,648	4,000

m Motor. * Compound. † Triple.

Schiffswerte und Maschinentabrik (Vorm. Janssen and Schmilinski) Act. Ges., Hamburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Anna	Steel	Hamburg	33	—	120
* Cuxhaven I.	„	Altona	41	—	120
* Mowe	„	Wismar	127	—	212
* Prima	„	Hamburg	45	—	200
* Secunda	„	„	45	—	200
* Syndikus Roeloffs	„	„	16	—	82
* Hemmoor I.	„	„	80	—	280

G. Seebeck Act. Ges., Bremerhaven.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Geir	Steel	Kopenhagen	—	332	700
† Björn, Tug Boat	„	Runvers	—	185	450
Ojarvide, Passenger Boat	„	Montevideo	—	278	700
* M.O.P. 225, 226, 227, 228, 229, Tug Boats	„	Buenos Ayres	—	78ea	150ea
* Hunt, Lachs, Stor, Tug Boats	„	Kiel	—	71ea	200ea

H. C. Stulcken & Sohn, Hamburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Senator Diestel, Fishing steamer, Schooner	Steel	Cuxhaven	—	205	375
* Wettern & Pluschau, 3, Tow-boat	„	Hamburg	—	40	170
* No. 365, Steam Launch	Wood	Abroad	—	5	16
No. 377, Barge	Steel	Hamburg	—	50	—
* Johann Wilhelm, Steam Launch	„	„	—	19	80
* No. 386-387 (2 Barge Vessels)	„	Abroad	—	15ea	40ea
No. 388-393 (6 Barge Vessels)	„	„	—	18ea	—
No. 394, Barge	„	„	—	15	—
No. 395, „	„	„	—	5	—
* No. 397, Steam Launch	Wood	„	—	19	55
No. 398-399 (2 Barge Vessels)	Steel	„	—	15ea	—

Stettiner Maschinenbau Act. Ges., "Vulcan," Stettin-Brebow.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
t Mainz, Cruiser	Steel	Kiel	—	3,100	27,000
† Deutschland, Ferry Steamer	„	Sassnitz	—	2,847	5,400
† Preussen	„	„	—	2,849	5,400
t Torpedo-boats, V. 162, V. 163, V. 164, V. 180, V. 181, V. 182	„	Kiel	—	550ea	16,000ea
* Box, Ferry Boat	—	—	—	36	90

Stettiner Oderwerke, Stettin.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Werner	Steel	Hamburg	875	—	650
† E. Russ	„	„	2,439	—	1,100
* Tender	„	Emden	300	—	200
† Greif	„	Stettin	617	—	400
* Eisbar	„	Breslau	73	—	180
* Spulbagger III.	„	Magdeburg	248	—	350
† Kraft	„	Kiel	592	—	1,000
† Junior	„	Lebbin	101	—	250
† Vorwarts	„	Hamburg	152	—	400
† Helene Russ	„	„	992	—	650

Stocks & Kolbe, Kiel.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Yard No. 146	Steel	Brazil	—	37	50
m „ 147	„	Konstanza	—	22	48eff
„ 148	„	Kiel	63	—	—
„ 149	„	„	63	—	—
m „ 152	Wood	„	—	1	6eff.
* „ 150	„	Brazil	—	62	120

Joh. C. Tecklenborg Act. Ges., Geestemunde.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† SS. 231, Niobe	Steel	Bremen	658	—	400
† SS. 230, Minneburg	„	„	4,748	—	2,500
a SS. 220	„	„	5,050	—	3,000
† SS. 232, Gunboat Otter	„	Imperial German Navy	350	—	1,500
a SS. 233, Pagenturm, SS. 234, Adamsturm	„	Bremen	5,000ea	—	2,800ea

Joh. Thormahlen Co., Elmshorn.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Margaretha, Schooner	Steel	Schulau	130	—	—
Bertha	„	Elmshorn	100	—	—
Hela, Schooner	„	Imkemwarder	120	—	—
Felix, Lighter	„	Kamerun	30	—	—

18 Lighters of about 1,195 tons.

G. H. Thyen, Brake a/d, Weser.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Move, Lugger	Steel	Leer	150	—	100

"Weser" Actien Gesellschaft, Gropilingen, Bremen.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Thuringen	Steel	Wilhelmshaven	—	—	—
Yard No. 380, Torpedo Boats and Floating Dock	„	Kiel	—	2,200	—
Yard No. 378-379, Schleusenthore	„	Bremen	—	700	—

J. H. W. Wichhorst, Hamburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Kohlenheber II.	Steel	Hamburg	350	—	—
* Vulcan Werft I., II., III	„	„	15ea	—	60ea
* Bugsir	„	„	12	—	40
* Vulcan	„	„	20	—	120

LIST OF VESSELS ENGINED IN 1909.

The North German Lloyd, Bremerhaven.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
a George Washington	Vulcan Co., Stettin	20,000	213
a Bisht	A. G. Weser, Bremen	14,000	220½

t Turbine. m Motor. * Compound. † Triple.

AUSTRIAN.

Austrian Lloyd's Steam Navigation Co., Trieste.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Linz, Meran, Karlsbad, Gastein (2 Masts) ..	Steel	Trieste	—	3,820ea	2,500ea
* T.S.S. Scutari (1 Mast) ..	,,	,,	—	262	350
Medua-Lloyd (Depot Barge)	Wood	,,	—	134	—
Oboti-Lloyd (Depot Barge)	,,	,,	—	75	—

Marco M. Martinolics, Lussinpiccolo.

* Nas	Steel	Ragusa	—	250	540
m No. 152	Wood	Lussplo.	—	135	100
* Nos. 153 and 154	Steel	Trieste	—	120ea	90ea

Stabilimento Tecnico. Trieste, Austria.—Two motor launches, Brioni and Jo; four torpedo boats, 110 tons displacement and 2,300 I.H.P. each; one passenger steamer, Vettor Pisani, of 120 tons gross and 500 I.H.P.; one oil lighter of 51 tons d.w.; four steam tugs of 47 tons displacement and 170 I.H.P. each, and two steam tugs, Traste and Orjen, of 28 tons displacement and 65 I.H.P. each.

HUNGARIAN.

Der Altofner Schiffswerte Donau Dampfschiff Gesells, Budapest.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Taussig, Passenger Side-Wheel Steamer	Steel	Wien	—	397	800
12 Covered Cargo Boats ..	,,	,,	—	321	—
11 Open Cargo Boats	,,	,,	—	291	—

DUTCH.

Arnhemsche Stoomsleephelling Maatschappij, Arnhem.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu erect	I.H.P.
† Rijn and Lek III., Tug ..	—	Dutch	200dis	—	360dis.
† Theodora, Tug	—	,,	215	—	400
* Victoire, Dredger, 2 engines	—	,,	250	—	200
† Aleida Johanna, Tug ..	—	,,	310		550
† Atlas V., Tug	—	Belgian	140		265
† Edmond Henriette, Tug ..	—	Dutch	240	—	450
† Transito II., Tug	—	Belgian	240	—	450
† Progres, Tug	—	,,	140	—	265
† Heimburg, Tug	—	German	130	—	200
† 'tKoggeschip, Tug	—	Dutch	85	—	100
† Heinrich, Tug	—	German	190	—	360
† Sacropuer, Tug	—	German	150	—	265
† Pieter Areud, Tug	—	Dutch	145	—	265
† 10 engines for Tugs and Dredgers	—	—	—	—	1,845

G. & H. Bodewes, Martenshoek.

Spero, Lighter	—	Holland	800	—	—
Johanna, Lighter	—	,,	350	—	—
Maria, Lighter	—	,,	400	—	—
Margarete, Johanne Antonie Both, Sailing Vessels ..	—	Germany	100ea	—	—
Martha and Cranz, Sailing Vessels	—	,,	120ea	—	—
Rehoboth, Sailing Vessel	—	Groningen	70	—	—
Henderika, Sailing Vessel ..	—	,,	60	—	—
Dankbaarheid	—	,,	105		—
* Alberdina Maria, Tug ..	—	,,	—	—	125
* Prinses Juliana, Tug ..	—	Delfzyl	—		160
† Zuid-Holland and Christiaan, Tugs	—	Dordrecht	—	—	160ea

H. H. Bodewes, Millingen.

Georg	Steel	Coblenz	450	—	—
Lina	,,	Frankfort	450	—	—
Fortuna	,,	Hassmers Leins	425	—	—
K. S. 32 ..	..	Duisburg	2,100		—
Kunigunde ..		Nierstein	850	—	—
K. S. 33		Duisburg	1,700		—
K. S. 34		,,	1,700	—	—

Firma Wed. C. Boele & Zonen, Slikkerveer bij Rotterdam.

No. 1, Lighter	—	Rio Grande do Sul	—	1,000	—
No. 2, Lighter	—	,,	—	1,100	—
† Honorio Bicalho, Tug	—	,,	—	—	200
† Silveira Alantin, Tug	—	,,	—	—	200
† Peter Caland, Tug ..	—	,,	—	—	175
No. 4, Lighter	—	,,	—	1,200	
No. 5, Lighter	—	,,	—	1,200	
† Hansa, Tug	—	Rotterdam	—	—	275
† Nijverheid, Tug	—	,,	—	—	80
Johanna Cornelia, Lighter	—	,,		800	

Bonn & Mees, Rotterdam.

† Gorontalo ..	Steel	Rotterdam	5,900		2,400
Rat ..		,,	40	—	—
† Terschelling		,,	3,500	—	1,500
14 Canoes ..		Foreign	390	—	

Gebr. Boof, Leiderdorp.

Yard "De Hoop."

Have built 7 Tugs, 18 Motor-boats, 1 Passenger Steamer, 1 Sailing Lugger, and a Dredging Mill.

Yard "De Waard."

Have built 11 Tugs, 4 Motor Vessels, and 1 Steam Cargo Boat.

Botze, Ensing & Co., Groningen.

* No. 67 ..	Steel	London	—	—	160
* Ready	,,	Southampton	—	—	25
* Munnehezyl	,,	Munnehezyl	—	—	40
* Johanna Jacoba	,,	Workum	—	—	40

* Compound. † Triple. m Motor.

The Fijenoord Co., Rotterdam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† G. 12, Torpedo-boat ..	Steel	Dutch Navy	—	—	2,000
† Swaerdecrom, Cargo and Passenger	,,	Batavia	1,700	—	1,100
* Prins der Nederlanden, Life-boat, America and Europa, Dredgers	,,	Hook of Holland	—	—	150ea
† Albatros, Customs Boat ..	,,	Dutch Govt.	—	—	260
Atjah, Cargo and Passenger Steamer	,,	Batavia	400	—	500
† Van der Hagen, Cargo and Passenger Steamer	,,	,,	2,900		1,600
† Saturnus, Cargo Boat ..	,,	Amsterdam	2,741	—	1,250

Koninklijke Nederlandsche Grofsmedery, Legden.

* Lawoe, Bucket Dredger ..	—	Soerabaia	—	—	60
14 Hopper Barges	—	Buenos Aires	—	—	—
m Four Hopper Barges	—	Soerabaia	—	100ea	60ea

Koninklijke Maatschappij "De Schelde" Scheepsbouw en Werktuigenfabriek.

T.S. Frisia, Mail Steamer ..		Amsterdam	7,440	—	5,000
SS. Tambora, Mail Steamer		Rotterdam	5,600	—	4,500

K. J. Koopman, Dordrecht.

‡‡Oder, Tug	Steel	Stettin	—	—	125
‡‡Rio Tinto, Tug	,,	Huelva	—	—	85
m Primus, Oyster Boat ..	—	Terseke	—	—	15B.H.P.
† Pelam, Tug	Steel	Dordrecht	—	—	250
† Taunus, Tug	,,	Hochst a/Main	—	—	150
‡‡Engines		—	—	—	180

N. V. Scheepsbouwwerf "Baanhoek," vorheen T. Nederlof.

2 Hopper & Elevator Barges	—	Sliedrecht	350ea	—	—
2 Elevator Barges	—	,,	570ea	—	—
† 2 Steamers	—	Antwerp	—	—	150ea
4 Boats for the Rhine		,,	700	—	—
		Mulheim and Nymegen	1,000ea	—	—
		Sliedrecht	600	—	—
2 Pontoons	—	Utrecht	—	—	—
1 Motorboat	—	Bleskensgraaf	16	—	—
3 Sealers	—	Sliedrecht			
		St. Tilipsland	220ea		
		Hoofelplant			

Nederlandsche Scheepsbouw-Maatschappij, Amsterdam.

† Stias	Steel	Amsterdam	5,917	—	2,300
† Hoofdinspecteur Zeeman ..	,,	Batavia	750	—	800
Utrecht	,,	Balik Papan	1,214	—	—
Limburg	,,	,,	1,221	—	—
Van Heemskerk	,,	Bataiva	2,996	—	1,300
Van Linschoten	,,	,,	3,000	—	1,300
† Ajax	,,	Balik Papan	256	—	650

Gebr. Pot, Ridderkerk.

Ampeteo	—	Rotterdam	800	—	—
* Antonia I.	—	Dordrecht	150	—	125
Nos. 25 and 26	—	Duisburg	1,000ea	—	
Vereinigung, No. 68, Vereinigung, No. 69	—	Mannheim	770ea	—	—
* Hassia	—	Rotterdam	310	—	2 × 165
No. 31	—	Antwerp	160	—	—
Brimsdown, Bow, Bromley, Stratford, Tottenham, Old Ford		London	130ea	—	—
Via Media		Dordrecht	730	—	—
No. 2		Rotterdam	140	—	—

P. & A. Ruytenburg, Waspik, N. Brabant.

Petro	—	—	1,114	—	—
Westland	—	—	444	—	—
Progres II.			882	—	—
Abacoad	—	—	950	—	—

Scheepswerf Vorheen Jan Smit Co., Alblasserdam.

† Noordwijk, Cargo Steamer	Steel	Rotterdam	—	2,125	1,100
Gertrud	,,	Oberlahustein	1,500	—	—
am Say Antonio	,,	Rotterdam	500	—	200
Robert	,,	Nechorgerach	1,500		—
Heinrich	,,	Nantes	1,500	—	—
Robert Sinner	,,	Abenheim	1,500	—	—

E. J. Smit & Zoon, Hoogezand.

462 Europa, Schooner ..	Steel	Groningen	180	—	—
463, Zeemeeuw, Schooner	,,	Hoogerand	180	—	—
466, Dorothea, Lighter ..	,,	Bremen	260	—	—
467, Hannover, Lighter ..	,,	Stolzenau	250	—	—
468, Thedinghausen III., Lighter	,,	Thedinghausen	270	—	—
p 471, Pim I., Motor Tank ..	—	Zaandam	20	—	30
p 473, Anna, Auxiliary Sailing	—	Amsterdam	50		36
* 475, Tug	—	Bremen	20	—	150

Firma A. F. Smulders, Schiedam.

* 347, Coaling Vessel	—	—	1,000	—	300
348-64, 17 Barges	—	—	2,720	—	—
* 365, Tevere, 366, Eridano, Suction Dredgers	—	—	450ea	—	200ea
* 367, Harpen, Coaling Vessel	—	—	1,600	—	600
* 371, Arno, Bucket Dredger	—	—	60	—	70
374-79, 6 Hopper Barges ..	—	—	960		—
385-89, 5 Hopper Barges ..	—	—	800		—

Van Vliet & Co., Hardinxveld.

Leuven, Verviers, Ostende, Weyst, Charleroi, Namur, Alost, 7 Lighters	Steel	Antwerp	1,500ea		—
Breeze, Cargo Steamer ..	,,	London	900		—
Lighter, St. Antonius ..	,,	Leeuwers	475	—	—

† Triple. * Compound. m Motor. ‡‡ Compound Surface Condensing. a Quadruple. p Petrol.

A. Vuijk & Zonen, Capello a.d. Yssel, near Rotterdam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
17 Lighters aggregating 20,429 tons.					
Shuna, Steamer	—	Glasgow	1,250	—	—
Boomberg, Steamer	—	Amsterdam	1,610	—	—

Werf Conrad, Ltd., Haarlem.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Drague, Dredger	—	Varna	250	—	130
* Pernambuco, Dredger ..	—	Pernambuco	240	—	200
* No. 407, Barge and Suction Dredger	—	Soerabaja	150	—	200
Sophie, Petroleum Motor-boat	—	Dutch port	80	—	56
* No. 413, Gold Dredger ..	—	Guyana Gold Placer	60	—	75
* No. 414, Dredger	—	—	280	—	200
† Alvarês Cabral, Barge and Suction Dredger	—	Bahia	415	—	900

Wilton's Engineering & Slipway Co., Rotterdam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Hop. 112 B. and Hop. 113 B.	Steel	Buenos Aires	110ea	195ea	250ea
m Giraffe	,,	Holland	120	200	50
m Edith	,,	,,	17	25	40
* Henngala and Donngala ..	,,	,,	250ea	620ea	250ea
* Bamania St. Joseph	,,	Belgium	30	50	80

Wortelboer & Co., Hoogezand.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Nassovia	Steel		400	—	—
Saxonia	,,	—	405	—	—
Gelria	,,	—	400	—	—
Skandia	,,	—	400	—	—
No. 46	,,	—	70	—	—

LIST OF VESSELS ENGINED IN 1909.

Koninklijke Maatschappij "De Schelde" Scheepsbouw en Werktuigenfabriek.

Name of Vessel.	Builders.	I.H.P.
† Noordwyk II.	Scheepswerf v/h J. Smit Can-Alblasserdam (Holland)	1,100
† Duiveland	N.V. "Werf" v/h Rykee & Co., Rotterdam	850
† Schieland	N.V. "Werf" v/h Rykee & Co., Rotterdam	850
* Samarang	Samarangsch Stoomboot & Prauwenveer te Samarang, Dutch India	100

Alblasserdamsche Machinefabriek, Alblasserdam.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* Delphine II. and Tunisien II.	Gebrs. Jonker	160ea	135ea
† Honorio Bicalho and Silveira Martins ..	Wed. C. Boele & Zoon ..	290	180ea
† Douton Jose Ewbank and Conselheiro Henrique Avila	Jonker & Stans	350ea	180ea
* Metalicus I.	Gebrs. Boot	110	165
† France and Europe ..	Jonker and Stans	425ea	180ea
† Hollander & El-Sielo .	Werf de Nord & Gebrs. Jonker	125ea	180ea
* Antwerpen	(Old ship)	50	120
† Peter Galand	Wed. C. Boele & Zoon ..	240	180
† Triton	Jonker & Stans	650	180

Kinderdijk Machinefabriek, Kinderdijk.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† M.O.P., 21 C ..	T. & K. Smit's Scheepswerven	600	105
* M.O.P., 22 C. .	,, ,, ,,	200	90
† Zeeland	,, ,, ,,	550	105
* Goteborg	,, ,, ,,	300	105
Piloto Campbell ..	,, ,, ,,	200	105
* Torpedodrenst II. ..	,, ,, ,,	100	105
† Politie II.	,, ,, ,,	200	120
* Mr. J. London	— —	200	105
—— .. .	T. & K. Smit's Scheepswerven	100	120

Lohnis & Co., Rotterdam.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* T.S. Randwijk ..	Boele & Pot	340	120
* Antonia I.	Gebrs. Pot	130	120
* T.S. Vreeswijk ..	Boele & Pot	350	120 superheated

Netherlands Engineering Co., Amsterdam.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† Koningin Wilhelmina	Nederl. Scheepsbouw My	330	160
† Oranje	,, ,, ..	250	160
† Pollux	Rybee & Co. .	1,200	180
† Nias	Nederl. Scheepsbouw My. .	2,400	180
† Hoofd Inspecteur Zeeman	,, ,, .. .	900	170
* Franley	Werf. Kromhout	180	120
† Von Eleemskerck ..	Nederl. Scheepsbouw My. ..	1,450	180

Wilton's Engineering & Slipway Co., Rotterdam.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† Combinatie I.	Old Vessel, re-engined and re-boilered	800	200
† Fram and Fiat Voluntas X.	,, ,, ..	350ea	200ea

Also 13 Marine Boilers, with a total heating surface of 10,000 sq. ft.

m Motor. * Compound. † Triple.

NORWEGIAN.

Akers Mekaniske Verkstad, Christiania.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Dagali	Steel	Christiania	—	742	440
† Start	,,	,,	—	701	440
† Halden	,,	Fredrikshald	—	195	375
† Burra	,,	Leith	—	106	375
† Verma	,,	Molde	—	280	600
† Henrik Ibsen	,,	Skien	—	179	435
† Borgny, 4-masted Sch. ..	,,	Christiania	—	1,149	740
† Brunla	,,	,,	—	750	645

Aktieselskabet Moss Værft Bjergnings & Dykker Co., Moss.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Mustadfors, Tug	Steel	Sweden	—	10	32
* Framnæs IV., Ferry St. ..	,,	Christiania	—	83	75

Bergen's Mekaniske Værksted, Bergen.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Hercules	Steel	Bergen	1,295	1,295	800
† Bianca	,,	,,	1,118	1,284	650
† Karlsborg	,,	Mem.	1,082	1,082	650
* Havnebaaten	,,	Bergen	34	34	80
* Titan	,,	,,	48	48	100

Christiansand Mekaniske Verksted, Christiansand.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† s.s Lindaas	Steel	Bergen	—	140	230
† s.s. Salpeter	,,	Skien	—	120	260
Kvina	,,	Flekkefjord	—	102	110

Fredriksstad Mek. Verksted, Fredriksstad.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† No. 123, Kattegat	Steel	Helsingberg	—	1,088	840
† No. 125, Standford	,,	Christiania	—	1,020	850
No. 126, Dredger	,,	,,	—	120	—
* No. 127, Fram	,,	,,	—	50	—
† No. 128, Bruno, ...	,,	,,	—	1,130	850
Nos. 129, 130, 131, Cargo Lighters	,,	,,	—	45ea	—
No. 132, Floating Crane ..	,,	Horten	—	700	350
Nos. 133 & 134, Hopper Barges	,,	Christiania	—	90ea	—
* No. 135, Ceement 3	,,	,,	—	40	130
Nos. 136 & 137, Cargo Lighters	,,	Dramus	—	45ea	—

A/S Laxevaags Maskin & Jernskibsbyggeri, Bergen.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Rimfakse	A/S Laxevaags Maskin and Jernskibsbyggeri				650
† Helga	,,	,,			650
† Rosendal	,,	,,			475
† Risoy	,,	,,			650
† Breidablik	,,	,,			650

Framnæs Mekaniske Verksted, Sande.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Penguin, Whaler	Steel	Larvik	168	—	300
† Pelican, Whaler	,,	,,	168	—	300

Steel Floating Dock for Christiania, 4,500 tons lift power.

Nylands Værksted, Christiania.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Flostero, Cargo Steamer ..	Steel	Arendal	—	688	450
† Vestfos ,, ..	,,	Christiania	—	1,388	900
† Haldane ,, ..	,,	Callafirth	—	110	280
Tank, Lighter	,,	Christiania	—	69	No Eng.
† Stadion, Cargo Steamer ..	,,	,,	—	519	350
† Kong Tuge ,, ..	,,	,,	—	750ab	600

Porsgrunds Mek. Værkstad, Porsgrund, Norway.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Gokstad	—	Arendal	700ab	700ab	500ab

Stavanger Stoberi & Dok, Stavanger.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† No. 59, Alliance, Schooner .	Steel	Arendal	459	—	300
† No. 60, Activ, Schooner ..	,,	,,	456	—	300
† No. 61, Alert, Schooner (nearly ready for launching)	,,	,,	460	—	300
† No. 62, Avanti	,,	,,	460ab	—	300

Trondhjems Mek. Værksted, Trondhjem, Norway.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Richard With	Steel	Stokmarknas		905	1,000
† Svein Jarl	,,	Trondhjem	—	1,136	600
† Driva	,,	Kristiansun	—	285	650
† Kysten	,,	Namsos	-	292	450
† s.s. 140	,,	Trondhjem		1,400	900

SWEDISH.

Bergsunds Meckaniska Verkstads Aktiebolag, Stockholm.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† 3 Torpedo-boats, Altair, Argo, and Polaris		Sweden	110ea		1,900ea
* Gustafshog	—	Stockholm		—	125

Eriksbergs Mek. Verkstad Aktiebolag, Gothenburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Brevik	Steel	Stockholm		94	700
G.H.S No .. Barge..	,,	Goteburg			
G.H.S No. 6, Barge.. ..	,,	,,			
* Sandhamns Express ..	,,	Stockholm		200	72

Goteborgs Nya Verkstads Aktiebolag, Gothenburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Antaris, 1st class Torpedo-boat		R.S.N.	1108 dis		1,850
† Arcturus, 1st class Torpedo-boat	—	R.S.N.	1108 ,,	—	1,850
S. 307, Dredger .. .	—	Goteburg	3508 ,,	—	
* Cronstadt, Tug		Cronstadt	708	—	200
2 Motor Boats					

Helsingborgs Varfs Aktiebolag, Helsingborg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Trettiotvaan, Schooner		Helsingborg	575	425	500

* Compound. † Triple.

Kockums Mekaniska Verkstads Aktiebolag, Malmo.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Lightship	Steel	Stockholm	—	—	—
Vidar, Tor.-boat Destroyer	—	,,	—	—	7,200
Lindholmens Verkstads Aktiebolag, Gothenburg.					
† Konung Gustaf V, Schooner	Steel	Trelleborg	3,075	—	4,500
* S.S. No. 403, Tug Boat ..	,,	Gothenburg	30	—	120
Motala Verkstads Nya Aktiebolag, Motala.					
† Valkyrian	Steel	Stockholm	—	88	130
† Angantyr	,,	,,	—	88	130
p Mina	,,	,,	—	—	45eff
Oscarshamns Mekaniska Verkstads Och Skeppsdockas Aktiebolag, Oskarshamn.					
* Kalmarsuna IX	Steel	Kalmar	484	—	500

Boiler fitted with super-heater.

DANISH.

Aktieselskabet Burmeister & Wains, Maskin-og. Skibsbyggeri, Copenhagen.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Orneu, Pass. St.	Steel	Danish	—	788	850
† Flora, Cargo & Pass. St. ..	,,	,,	—	1,218	1,580
† T.S. Odin, Railway Ferry	,,	,,	—	1,503	1,850

H. V. Buhl & Co., Frederikshavns.

No vessels launched during 1909.

Copenhagen Floating Dock & Shipworks, Ltd., Copenhagen.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Selvlosseren, Barge	—	Copenhagen	30ab	—	—
* Hejren, T.S. Pass. steamer	—	Silkeborg	90 ,,	—	75
Alpha, Floating coaling elevator..	—	Copenhagen	100 ,,	—	90
† Prachatipok, schooner passenger & cargo steamer	Steel	Bangkok	968	—	500
Actieselskabet Helsingors Jernskibs-og. Maskinbyggeri, Elsinore.					
† s.s. Gulfaxe	Steel	Copenhagen	1,684	—	700
* t.s.s. Henriette	,,	Nakskor	380ab	—	180

RUSSIAN.

Societe Anonyme Chantiers Navals, Ateliers et Fonderies de Nicolaieff, Nicolaieff.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* No. 83, Paddle Tug	Steel	Sevastopol	130	—	2 × 100
† No. 84, Suction Dredger ..	,,	Dnieprc	200	—	300
No. 86, Paddle Tug and Passenger	,,	Cherson	100	—	120
T. R. Eales & Son, St. Petersburg.					
† Priboy, Tug..	Steel	St. Petersburg	50dis.	—	100
* T.S. Rabatniza, Cargo Str.	,,	,,	—	100	120
T.S. Onega, Cargo Steamer .	,,	Petrozavodck	430dis.	—	240

ITALIAN.

Amerigo Gori, Leghorn.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Villa, Ferry Boat	Steel	Unknown	900	—	1,400
Buoni Amici, 3-Masted Schr	Wood	Leghorn	266	—	—
Ditta Giovanni Poli, Chioggia.					
Emilia & Lazio . .	Steel	Chioggia	175ea	—	—
Umbria	,,	,,	176	—	—
Ferry Boat	Wood	Venice	60	—	—
4 Barges	Steel	,,	120	—	—
Gio. Ansaldo Armstrong et Cia, Sestri-Ponente.					
† Nos. 147, Fuciliere, 148, Carabiniere, 150, Alpino, Torpedo-boat Destroyers, liquid fuel combustion .	Steel	Spezia	534		6,000

149, 145, 146, sister ships to the above, with coal combustion.

SPANISH.

Compania Euskalduna de Construccion y Reparacion de Buques, Bilbao.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† S.S. Cabo Sacratif, Schooner, awning and deck ..	Steel	Sevilla		2,173	187

GRECIAN.

M. Contoudakis, Syra, Greece.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Aoghi	Wood	Syra	60	—	110

† Triple. *p* Petrol. * Compound.

AMERICAN.

T. Adair, East Boothbay.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Topsail Girl, Schooner ..	Wood	Portland	62	—	24
Edmund F. Black, Schooner	,,	,,	66	—	20
Bath Marine Construction Co., Bath.					
Kanawha	Wood	Portland	37	—	100
Adine, Raised Deck Cruiser	—	—	—	—	—
Name unknown	—	Sidney, Nova Scotia	—	—	50

All others, small gasolene boats, not registered, about 20 all told.

The American Car & Foundry Co., Wilmington.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Dumping Schooner	—	Providence, R.I.	800	—	—
5 Lighters	—	Philadelphia, Pa.	600ea	—	—
Pomiganset, Lighter	—	Providence, R.I.	1,000	—	—
Gillin Bros., Steam Lighter	—	New York	200	—	—
M. P. Howlett, Tow Boat ..	—	Philadelphia, Pa.	100	—	—
Nos. 41 & 42, Car Floats..	—	,,	700ea	—	—
F. S. Bowker & Son, Phippsburg, Maine.					
Richard W. Clark, 3 Masts	—	N. Bedford, Mass.	504	—	—
J. Cherry	—	Charleston, S.C.	533	—	—

Fairbank's & Morse Gasolene Engine put to Cargo, etc.

Wm. Cramp & Sons, Ship & Engine Building Co., Philadelphia.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
t Jos. B. Smith and Roswell H. Lamson, Torpedo-boat Destroyers	Steel	U.S. Navy	—	ea700dis	10,000ea
Atlas	,,	New York	—	418 ,,	—
† Gen. Geo. Weeks, Gen. S. B. Holabird, Gen. Morgan Lewis	,,	Harbour Service & Submarine Mine Planters, Quartermaster General's Dept., U.S. Army	—	ea399 ,,	500ea
G. G. Deering Company, Bath, Maine.					
Mary L. Baxter, 4 Mast Sch.	—	Bath	1,032	—	—
J. H. Dialogue & Son, Camden, New Jersey.					
* J. W. Thompson, Schooner	Steel	St. Louis	186	—	400
† Parksley, Schooner	,,	Philadelphia	296	—	800
* La Criado	,,	,,	186	—	350
Electric Launch Co., Bayonne.					
6 U.S. Lifeboats	Wood	Various	—	—	25
4 ,, ...	,,	,,	—	—	38
Ostrich	,,	Alexandria Bay	—	—	50
Cythera II.	,,	Detroit	—	—	50
Dreadnought	,,	Bar Harbor	—	—	50
Courier	,,	Wilkisbarn	—	—	30
Viking & Shata	,,	New York	—	—	30ea
Haida Poppoos	,,	,,	—	—	40
Maisie	,,	Chicago	—	—	50
Blanchette	,,	New York	—	—	50
Comrade, Schooner	,,	Tuckerton	—	30	20
Iola and Hadjr	,,	New York	—	—	40ea
Igloo	,,	Chicago	—	42	60
W. A. Fletcher & Co., Hoboken, N.Y.					
Robert Fulton, Paddle Str.	—	New York	2,168	—	3,900
Trojan, Paddle Steamer ..	—	,,	2,571	—	2,000
Rensselaer, Paddle Steamer	—	,,	2,571	—	2,000
Fore River Shipbuilding Co., Quincy, Mass.					
North Dakota	—	U.S. Gov.	—	dis20,000	20,000
6 Submarines	—	,,	—	—	—
2 Tugs ..		U.S. Army	—	—	—
3 Car Floats .	—	U.S.A.	—	—	—
Transfer, Tug .	—	,,	—	—	—
c Aloha, Steam Yacht	—	,,	—	—	400
c Herman Frasch, Sulphur Str.	—	,,	—	—	2,100
2 Lighters	—	—	—	—	—
3 Molasses Barges .. .	—	—	—	—	—
Harlan & Hollingsworth Corporation, Wilmington, Delaware.					
† New London, Freight ..	Steel	Portland, Ma.	2,818	3,025	1,800
† New York, Freight	,,	,,	2,818	3,025	1,800
† City of Wilmington, Freight and Passenger	,,	Wilmington, Del.	669	872	1,400
† City of Philadelphia, Freight and Passenger	,,	,,	669	872	1,400
Car Float No. 41, C.R.R. Co. of N.J.	,,	Jersey City, N.J.	852	852	—
Car Float No. 42, C.R.R. Co. of N.J.	,,	,,	852	852	—
Maryland Steel Co., Sparrows Point, Maryland.					
No. 96, no name	Steel	—	—	150	—
† No. 97, Mars	,,	Baltimore	—	5,451	3,750
† No. 98, Vulcan	,,	,,	—	5,451	3,750
† No. 99, Hector	,,	,,	—	5,451	3,750
No. 100, Pascagoula ..	,,	—	—	250	—
No. 101, J. D. Fletcher ..	,,	—	—	1,000	—
No. 102, Porto Alegre ..	,,	—	—	250	—
b No. 103, Three Rivers ..	,,	Baltimore	—	900	1,000
† United States, Passenger ..	Steel	Michigan City, Ind.	—	1,711	2,500

t Turbine. † Triple. * Compound. *c* Single Cylinder. *b* Beam Engine.

Manitowoc Dry Dock Co., Manitowoc, Wis.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
‡ Jas. A. Pugh, Lighter..	Steel	Chicago Ill.	—	401	375
* Manitowoc, Survey Steamer	,,	Milwaukee, Wis.	—	174	350
† Alabama, Passenger ..	Steel	Duluth, Minn.	—	est2,700	2,500

The Moran Company, Seattle, Washington.

Gulkana	Wood	—	—	180	150
Nizina	,,	—	—	345	150
Tonsina	,,	—	—	450	275

Newport News Shipbuilding & Dry Docks Co., Newport News, Virginia.

Delaware, U.S. Battleship..	—	Navy Dept., Wash.	20,000dis	—	—
Roe and Terry, Torpedo-boat Destroyers	—	,,	ea742 ,,	—	—
† Jean, Freight Steamer ..	—	New York	—	2,800	1,500
† Wilhelmina, Frt. & Pas. ..	—	San Francisco	—	6,800	6,000
* John Twohy, Jr., Tug ..	Wood	Norfolk	—	190	500
Standard Oil Co. of La. A	(Barge)	Baton Rouge, La.	—	700	—
,, ,, B	,,	,,	—	700	—
,, ,, C	,,	,,	—	700	—
† Bear, Freight & Passenger	—	San Francisco	—	4,100	4,000
† Beaver, Freight & Passenger	—	,,	—	4,100	4,000

Percy & Small, Bath, Maine.

Wyoming, 6-Masted Schr.	Wood	Bath, Me.	3,729		—

New York Shipbuilding Co., Camden, N.J.

Bloomsbury, Blackwood, Berkshire, Buck Mountain, Coal Barges	Steel	New York	934ea	—	—
* Gen. S. M. Mills, Gen. T. M. Schofield, Gen. R. T. Frank, T.S. Mine Planters	,,	U.S. Govt.	ea 680 dis	—	900ea
4 Car Floats, Nos. 46, 47, 48, 49	,,	New York	1,040 (2) 1,200 (2)	—	12 & 16
Robert Fulton, side wheel ..	—	,,	216	—	5,000
2 Car Floats	Steel	,,	1,200 dis	—	—
1 Transfer Barge, No. 16, Dimensions, 340 by 48 by 126 ft.	—	—	1,288	—	—
2 S. O. Co. Barges, Nos. 10 and 11	—	New York	1,113	—	—
Mastodon, Transfer Barge	Steel	New Orleans	2,863	—	—
t T.B. Destroyer Preston ..	,,	U.S. Govt.	700 dis	—	10,000

Risdon Iron & Locomotive Works, Stewart & Tolsons Sts., San Francisco.

* David Scannell, Fireboat..	—	San Francisco	—	300	600
* Dennis T. Sullivan, Fireboat	—	,,		300	600

The Skinner Shipbuilding & Dry Dock Co., Locust Point, Baltimore.

* Geo. L. Potter, Tug ..	—	New York	220	—	900

Southern Pacific Railway Co., Oakland, Cal.

* Navajo, Stern Wheel Steamer	Wood	San Francisco	—	968	1,300
* Melrose Side Wheel Steamer	,,	,,	—	2,662	1,300

Joseph Supple, Portland, Oregon.

† Hyak	Wood	Seattle	265	—	150
* Hunter (rebuilt)	,,	Bellingham	210	—	400

LIST OF VESSELS ENGINED IN 1909.

Ferro Machine & Foundry Co., Cleveland, Ohio.

Ferro, Durban, S.A.	Cleveland Auto-Boat Mfg. Co., Cleveland, U.S.A. ..	25	
Tinro	Aug. Petersen and Ch. Brown, Papeater Tahiti Islands ..	25	—
Penney, Philadelphia, U.S.A.	W. C. Van Sant, Port Republic, N.J.	15	—
Veronia	John Wellers, Carlstadt, N.J.	25	—
Craigflower	R. W. Troup, Victoria, B.C.	17	—

James Rees & Sons Co., Pittsburg, Pa.

Calda	James Rees & Sons Co.	300	180
Middeline	,, ,, ..	300	180
Oregon	,, ,, ..	60	170

CANADIAN.

Joseph McGill, Shelbourne, N.S.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu. erect.	I H P
Aspy, Steam	Wood	Shelbourne	124 ft. × 25 ft. × 9 ft.		
Granville	,,	,,	110 ft. × 22 ft. × 9 ft.		
Lulu S., Sailing Schooner..	,,	,,		23	—

Polson Ironworks, Toronto.

Erl King, Tug Boat ..	Composite	Toronto		60	200

L. D. Schaffner, Bridgetown, Annapolis, N.S.

Jeanne A. Pickles, Iron Sch.		Annapolis		200	

Toronto Shipyard Co., Toronto.

Scow No. 2	Steel				
Scow No. 3	,,				
* Silverland	,,	Haileybury		150ab	150
† Queen of Tenegami ..	Compo.	Tenegami		50ab	100

‡ High Pressure. † Triple. * Compound. *t* Turbine.

AUSTRALIAN.

Morrison & Sinclair, Balmain, N.S.W.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu. erect.	I H P.
Kanimbla, Ferry Steamer .	Wood	Sydney	—	—	—
m Royal Endeavour, Auxiliary Schooner	Wood	,,	—	62	55

LIST OF VESSELS ENGINED IN 1909.

Morts Dock and Engineering Co., Ltd., Balmain, Sydney.

Name of Vessel.	Builders.	I H P.	Press. lbs.
† Killara	D. Drake, Sydney.. .	550	180
* Clarence	W. Dunn, Clarence River	270	130

JAPANESE.

The Imperial Dockyard, Maizurn.

Name of Vessel.	Built of	Owners.	G T Regis	G.T. inclu. erect.	I.H P.
† T.B.D. Ayanami.. ..	Spl. Steel	—	—	425	6,350

The Ishikawajima Shipbuilding and Engineering Co., Ltd., Tokyo.

4 Steel Hopper Barges	Steel	Shimizu	—		80
* 1 Steam Tug	,,	Tokyo	22		80

Ono Shipyard, Osaka.

† Kyodo-Maru, No. 11 Sloop	Steel	Tokushima		401	570
† Ono-Maru, No. 7 Schooner .	,,	Osaka	—	780	500
* Kyodo-Maru, No. 12 Sloop	,,	Tokushima	—	50	80

The Osaka Iron Works, Osaka.

† Fuso-Maru	Steel	Tokyo	993	—	—
† Unyo-Maru	,,	,,	448	—	—
† Owada-Maru	,,	—	442	—	—
* Namikiri-Maru	,,		—	—	—
Rikugun Unyubu (Tank) ..	,,	—	100	—	—
* Miyato-Maru Tug Boat ..	,,	—	74	—	—
* Maitsuru-Maru, Prop. Dredger	,,	—	—	—	—
† Dairyo-Maru	,,	—	108	—	—
* Naimusho, Suction Dredger	,,	—		—	—
* ,, ,, ,,	,,	—	—	—	—
* Haneda-Maru, Tug Boat ..	,,	—	—		—
South Manchurian Ry. Co., Barge-bottom Hopper ..	,,	—	300	—	—
,, ,, ,,	,,	—	300		—
Tetto-Maru, Ice Breaker ..	,,	—	120	—	—
Kyoyeki-Maru	Wood	—	100		

The Usago Dock Co., Ltd., Tokyo.

* Miho, Launch ..	Wood	Yokohama		14	35
* Hayabusamaru, No. 1 Launch	..	Shimidzu,		17	75
* Hayabusamaru, No. 2 Launch	..	..		17	75
* Fuji No. 2, non-propelling Bucket Dredger ..	Steel			150	80

The Mitsu Bishi Dockyard and Engine Works, Nagasaki.

† Kitano-Maru	Steel	Tokyo	—	6,512	9,051
t Umegaka-Maru	,,	,,		5,272	9,414
† Kiyo-Maru	,,	,,		9,320	3,500

Engined by the Company.

CHINESE.

The New Engineering and Shipbuilding Works, Ltd., Shanghai.

Name of Vessel.	Built of	Owners.	G. T. Regis	G.T. inclu. erect	I H P.
Ariel, Cargo Pontoon.. .	Steel	Shanghai	—	731	—
Dock Caisson	,,	,,		212	—
m Asiatica	,,	,,		245	120
* Norah	,,	,,	—	55	90
No. 170	,,	,,		27	75
* Meitoo IV.	Teak	,,		40	40
* Pussy	,,	,,	—	53	75
m No. 163	,,	,,	—	55	56
2 Pontoons	Steel	,,		75	—
6 Barges	Wood	,,	—	780	—

The Shanghai Dock and Engineering Co., Ltd., Shanghai.

4 Cargo Boats	Steel	Shanghai	124		
Nanking, Pontoon Opium Receiving Ship	,,	,,		1,020	
Hein, St. L.	,,	,,		—	100
Mitchell, Tug	,,	Manila	48		250
McConville, Tug	,,	,,	48		250
Ledyard, Tug	,,	,,	48		250
Adams, St. L.	,,	,,			140
Tilly, St. L.	,,	,,			140
Forby, St. L.	,,	,,			140

HONG-KONG.

The Hong-Kong and Whampoa Dock Co., Ltd., Hong-Kong.

Name of Vessel.	Built of	Owners	G. T Regis	G. T inclu. erect	I H.P.
* No. 7	Wood	Hong-Kong	[illegible]		160
* On Lee	Steel	,,	670		700
* Yard No. 458	,,	Manilla	110		320
6 Lighters		,,	6pea		
6 Lighters	Wood	,,	26a		
2 Motor Boats	Wood	,,			[illegible]

m Motor. † Triple. * Compound. *t* Turbine.

Taikoo Dockyard and Engineering Co., of Hong-Kong, Ltd.

* 101, Steam Launch	60 ft. × 10 ft. × 5 ft. 4 in.
102, Motor Launch	66 ft. × 10 ft. × 5 ft.
104-106, Steel Barges	70 ft. long.
107, Steam Launch	65 ft. long.
108, Steel Tug	90 ft. long.
109-110, Steel Barges ..	100 ft. long.
111, Motor Launch	36 ft. 3 in. × 7 ft. 6 in.
112, Steam Launch	70 ft. × 12 ft.
114, Pontoon	180 ft. × 28 ft. 6 in.

INDIAN.

Chas. Brown & Co., Dock Iron Works, Bombay.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
2 Sailing Barges		B.S.N.Co.	300dw		
5 „ „		Austrian Lloyd's	500dw		
2 Towing Barges		M. & S.M. Rail. Co.	140dw.	—	
1 Water Boat & Tender		B.I.S.N.Co.	168dw.		*245

STRAITS SETTLEMENTS.

Riley, Hargreaves & Co., Ltd., Singapore.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect	I.H.P.
No. 242	—	—	32	—	—
m No. 253, Saigon, Motor Lighter	Wood	Saigon	94	94	50B.H.P.
m No. 255 Dorine, Auxiliary Yawl	—	Batavia	10	10	13
m No. 256, Motor Water Boat	Wood	Singapore	85	85	50B.H.P.
Sir John Jackson, Nos. 16, 17, 18, Hopper Barges ..	Steel	„	95		—

(Built by Lobnitz & Co., Renfrew, put together and launched in Singapore by Riley, Hargreaves & Co., Ltd.)

T. & J. Railton, Nos. 35, 36, 37, Lighters	Steel	Singapore	110		

(Built by Edwards & Co., Ltd., Millwall, put together and launched in Singapore by Riley, Hargreaves & Co.)

The Tanjong Pagar Dock Board, Singapore.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect	I.H.P.
Steel Caisson		—	224	224	—
Crane Pontoon		Singapore	80	80	
Crane Pontoon		„	80	80	
Launch Hull		Kneking	40	45	
* Malaya ..		Singapore	37	40	145
* Sauda		„	70	82	240
Wood Pontoon		„	66		
Steel Barge, Nos. 13, 14, 15, 16		„	148ea	160ea	
Hopper Barge		„	100		
* Alert		Penang	40	45	150
* Launch No. 4		Singapore	30	32	120

WORK COMPLETED DURING THE YEAR.

ENGLISH.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—Particulars of various classes of vessels built at Walker and Elswick Shipyards from 1882 to 1909.

	No.	Gross Tonnage	I.H.P.
War Vessels ..	122	321,262	803,955
Passenger and Cargo Steamers	424	652,970	388,451
Petroleum Steamers	97	280,075	141,626
Ice-breakers, Dredgers, etc	85	51,270	39,220
Paddle Steamers	93	24,840	29,556
	821	1,330,417	1,402,808
Totals for the last nine years		416,028	471,330
Average per annum ..		46,225	52,370
Maximum in one year		74,228	63,700

The Blyth Shipbuilding and Dry Docks Co., Ltd.—In addition to being shipbuilders the Blyth Shipbuilding and Dry Docks Co., Ltd., are repairers of hulls and machinery, and in this department have during the year carried out some extensive repair jobs and alterations. Their five graving docks and ample facilities enable them to do work very expeditiously.

R. & W. Hawthorn, Leslie & Co., Ltd., Hebburn-on-Tyne.—The torpedo boats Nos. 33 and 34, and H.M.S. Zulu, built by the Company, have been engined and boilered by Messrs. R. & W. Hawthorn, Leslie & Co., Ltd., at their St. Peter's Works.

The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne.—Four fine large deadweight carrying steamers, two for Messrs. Furness, Withy & Co., Ltd.'s, Rotterdam-Baltimore Line to carry about 8,800 tons, and two to carry about 8,100 tons for Mr. D. Tripcovich, for whom the Company has already built several fine steamers. There are also several of the Company's well-known types of vessel to carry 7,500 tons each, two being repeat orders for Messrs. Thomas Dunlop & Sons, and another for Messrs. John Greenlees and Co., of Glasgow, and a fine cargo vessel for The Court Line, London, to carry about 7,500 tons. Included in the work at present in hand are other four of 7,500 tons deadweight steamers, four single-deck steamers of about 7,250 deadweight capacity, and one vessel to carry 8,800 tons. There is work on hand to keep the Company busy during the whole of the winter months.

* Compound *m* Motor.

The Shields Engineering and Dry Dock Co., Ltd., North Shields.—In addition to the seventeen vessels engined, the firm has been very busy during the past year with repair work, having reboilered and reclassed six vessels, and have also docked over 250 vessels for various repairs.

John Readhead & Sons, Ltd., South Shields.—The increase in tonnage for the year is 7,096, and they have done a large amount of work in their Graving Dock Department.

S. P. Austin & Son, Ltd., Sunderland.—The Pontoon and Graving Docks belonging to the company have been well occupied during the year, the total tonnage of the vessels docked being 250,000 gross register and in addition to extensive damage repairs and survey work carried out in the docks, a large number of vessels have been repaired at their Quays. Re-boilering work and repairs to machinery have also been extensively carried out and, notwithstanding the depression which has hung over the shipbuilding trade in Sunderland during the year, there has been an amount of activity at this yard.

Sir Raylton Dixon & Co., Ltd.—In addition to vessels launched, a large amount of repairing work has been done, and of the 12,661 tons nearly 11,000 are of the patent cantilever type. The Paulina Victor Hugo, Rochester City, and No. 547 s.s. being patent cantilever framed top side tank steamers.

W. Gray & Co., Ltd.—In addition to vessels launched, the total indicated horse-power of machinery turned out by the Central Marine Engine Works of William Gray & Co., Ltd., including engines other than for ships named in launch columns, was 17,300.

The Central Marine Engine Works, West Hartlepool.—The whole of the machinery output for the year has been of the triple-expansion type. In the boiler department, a large number of boilers have been made, amongst them being boilers for the Crown Agents for the Colonies and the Admiralty. The Drop Forging Plant has been actively employed, and numerous additions have been made to the already large stock of dies.

Irvine's Shipbuilding and Dry Dock Co., Ltd., West Hartlepool.—During the year 1909 upwards of 300 vessels have been docked and repaired, one vessel was lengthened 30 ft., and many others extensively repaired. The salvage plant has been well employed, two wrecks were blown up and other salvage work performed.

Earle's Shipbuilding and Engineering Co., Ltd., Hull.—I.H.P. of machinery for renewals and vessels built elsewhere, 11,700.

Joseph Scarr & Sons, Beverley, have repaired thirty-six vessels this year, the majority being extensive jobs.

Routh & Waddingham, Winteringham, have had a fair amount of repairing work in river and coasting vessels.

W. H. Warren, New Holland, in addition have lengthened a steam trawler, and their patent slip has been fairly busy during 1909. The prospects for 1910 are good.

Cox & Co., Falmouth, have supplied and fitted new boilers and machinery to several other vessels, besides sundry other work and repairs.

Nicholson & Sons, Glasson Docks, Liverpool, have been fairly busy in dry dock repairing vessels during the year.

North-Eastern Marine Engineering Co., Ltd., Wallsend and Sunderland.—Of the total output, 47,738 I.H.P. was constructed at the Wallsend Works, and 37,700 I.H.P. at Sunderland Works.

Swan, Hunter & Wigham Richardson, Ltd., Wallsend and Walker-on-Tyne.—In addition to tonnage launched, many extensive repairs to ships and engines were executed in the Dry Docks Department. During the seven years ending 1909 the firm have launched 150 vessels of 569,482 gross tons; an average of 21 vessels of 81,354 gross tons. Maximum (in year 1906), 25 vessels of 126,021 gross tons. The Cunard R.M.S. Mauretania, built by Messrs. Swan, Hunter & Wigham Richardson, crossed the Atlantic in September, 1909, at an average speed of 26·06 knots (or over 30 miles) an hour. She has maintained an average speed of 25·50 knots during twenty-five consecutive trips covering about 72,000 knots. She holds all the Atlantic records both eastward and westward for highest daily runs, fastest and shortest passages and highest speed.

ENGINES.

Blair & Co., Ltd., Stockton-on-Tees.—In addition to vessels engined nine new boilers have been built for other engine builders, trawlers and donkey boiler purposes, having an aggregate H.P. of 3,630. Total I.H.P. for the year, 26,725.

Richardsons, Westgarth & Co., Ltd., Hartlepool.—In addition to vessels engined, steam and gas engines and marine and water tube boilers, a large amount of miscellaneous work has been completed, including "Contraflo" Condensing Plants, Talbot Furnaces and other Steel Works Plant.

Sisson & Co., Ltd., Gloucester.—In addition to vessels engined, about 1000 I.H.P. of "Sisson" High-speed enclosed engine has been completed, and orders are in hand for about 600 I.H.P.

The Wallsend Slipway and Engineering Co., Ltd., Wallsend-on-Tyne.—In addition to vessels engined, new boilers have been supplied to vessels representing a total horse power of 6,960.

The United States Metallic Packing Co., Ltd., Soho Works, Bradford, have fitted their metallic packings to the following vessels during the year:—H.M.S.'s Ettrick, Usk, King Edward VII., Wear, Diamond, Welland, Harlequin, Ribble, Erne, Cherwell, Hellespont, Ure, Resource, Dee, Swale; s.s.'s New York Columbia, Massilia, Maharajah, Mallina, new steamer for Australasian United Steam Navigation Co.; s.s.'s Minderoo, Armadale Gasteina, Stambul, Broom, Serajevo, Albanien, Adelsberg, Mary Emily, Leicestershire; new steamer for Bibby Bros. & Co.; new ferry steamer for Birkenhead Corporation, Woodside Ferries; s. Netravati; new steamer for Boscovitch Steamship Co.; s.s.'s Rohilla, Tiger, Mataram, Carron; Marchioness of Lorne; s.T. Brisk; new steamers for Calcutta Port Commissioners; s.s.'s La Rochelle, Sin-Mac; new steamer; s.s.'s Tortona, Loiret, Deux Sevres, Vendee, Indre, Sarthe, Mayenne, Ardmore, Star of Canada, William Cory; new steamer for Wm. Cory & Son, Ltd.; s.s.'s Fiona Caronia; new steamer for Cunard Steamship Co., Ltd.; s.s. Ocean Queen; new steamer for J. Dunn and Co.; s.s.'s Tortuguero, City of Colombia, Luabo, new steamer for Empreza Nacionaldh Navigacao; s.s.'s Argentina, Golden Eagle, Loyal Briton, Orion; new steamers for Great Central Railway Co., and W. R. Grace & Co.; dredger

Mawhera; s.s.'s Haller, Harpeake, Artist, Student, Craftsman, Hinzada, Bramley, Whitgift, Honorius; new steamer for J. & P. Hutcheson & Co., s.s.'s Marimbula, Alexandra; 3 new steamers; s.s.'s Derwent, Dearne, Saltmarsh, Nidd; S.Y. Moranda; s.s. Karoola; new steamer for McBrayne and Co.; s.s.'s Romera, Masunda, Astrachan, Ruahine, Zaiko Maru; P.S. William Muir; s.s.'s Itapuca, Itapema, Otway, Orsova, Osterley, Otranto, Orvieto; two new yachts; s.t.'s Vesta and Mole; s.s.'s Rustington, Don Hugo, Swansea Vale; R.M.S.'s Avon, Agadir, Arzila, Aragon, Berbice, Asturias, Amazon, Balantia, Araguaya; s.s.'s Haxby, Yearby, Holtby, Burnby, Oakby, and 1 for Ropner & Co.; new steamer; cruiser Norna; s.s.'s Semlish Wheatfield, Mira, Aras, Suram; fishery protection boats; four gunboats; s.s. Cloutsham; new steamers for Tatem & Co.; 4 hoppers; s.s.'s Grantully Castle, Garth Castle, Balmoral Castle, Camosun; new steamers for United Fruit Co.; s.s.'s Metapan, Santa Marta, Almiranti, Doria, Badia, Vinia, s.y. Bantam; s.s.'s Wookata, Aaro, Margam Abbey, Princes Juliana, Oranji Nassau, Mecklenburg.

SCOTCH.

The Ailsa Shipbuilding Co., Ltd., Troon and Ayr.—In addition to vessels launched the Company engined the s.s.'s Itapuca, Itapema and Laverock.

Dundee Shipbuilding Co., Ltd., Dundee.—In addition to vessels launched, they have done a large amount of repair work to both hulls and engines.

The John Duthie Torry Shipbuilding Co., Aberdeen.—In addition to vessels launched, the firm have also done a considerable amount of repair work, including two very extensive jobs, *viz.*, repairs to s.s. Tillydrine, of Dundee, which has been ashore a little north of Aberdeen, and sustained such serious damage that nearly half the steel work of the vessel had to be renewed. Also alterations and reconstruction of the steam yacht St. Sunniva, belonging to the North of Scotland, Orkney and Shetland Steam Navigation Co., Ltd. The interior of the vessel was almost entirely gutted out and refitted up with new saloons, state-rooms and berths, also accommodation for cattle and sheep in 'tween deck and lower hold, in addition there was fitted a new boat deck and new promenade deck and ten large state-rooms on deck to give additional passenger accommodation.

Hall, Russell & Co., Ltd., Aberdeen.—All the engines and boilers for vessels launched, with the exception of engines for the John E. Lewis, have been constructed by Messrs. Hall, Russell & Co., Ltd.

ENGINES.

Barclay, Curle, & Co., Ltd., Whiteinch, Glasgow.—In addition to vessels launched and engined, twenty-three boilers have been built of a total I.H.P. of 13,110 for shipment.

Dunsmuir & Jackson, Ltd., Glasgow, have also built a number of new boilers and done some repair work.

Ross & Duncan, Glasgow.—Forty-two sets of 12,950 horse power.

S. & H. Morton & Co., Victoria Dock, Leith, have also built 1 Marine Slipway Hauling Engine and Gear to the order of Bombay Pub. Trust; non-condensing, 2 cylinder Vertical Inverted Cylinders, 10 in. by 12 in., W.P., 100 lbs. Capable of Handling vessels of 275 tons displacement. A large number of Horizontal Steam Cargo Winches, 6 in. by 10 in. and 7 in. by 10 in., for various owners, have been supplied, and have done general ship and engine repairs throughout the year.

Sturrock's Patent Bridge for Boiler Furnaces.—The Sturrock Patent Bridge and Engineering Co., Dundee, iuform us that the decided economic advantages, as well as the great convenience, which these metal bridges (taking the place of the ordinary built-up bridge of brick construction) possess, for cleaning and inspection, are matters which more and more commend them to sea-going engineers and marine superintendents. The managers and engineers of the bigger lines of ocean steamers are taking up the bridge strongly, and apart from that between 400 and 500 steamers have boilers now fitted with the bridge. The bridge, briefly stated, is composed of cast-iron segments so disposed and so arranged with air inlets and interstices, as to provide, at moderate cost, a bridge wall indestructible in character, yet which is easy of removal and replacement without sacrifice of the material composing it, and which is contributory to perfect combustion of fuel, as well, of course, as to smoke consumption. Prospects for the year now entered upon, the company inform us, are very satisfactory.

Howden's Forced Draught.—James Howden & Co., Ltd., Scotland Street, Glasgow, have in spite of the bad times been quite busy during the past twelve months, and have in hand at the present moment forced draught installations for over 160 large vessels. The popularity of their hot-air forced-draught system is always increasing, and many additional improvements have been recently introduced by them, the chief of which is their new patent "single action" safety valve of furnace front which reduces by one-half the work in operating the valves, etc., while at the same time absolutely preventing the possibility of any accident through carelessness on the part of the stoker, the furnace door being so arranged that it cannot be opened until the side valves are shut. Messrs. Howden are also supplying large numbers of their enclosed forced lubrication double-acting engines for driving dynamos and centrifugal pumps, as well as their forced draught fans. In many steamers they are supplying all these engines as duplicates so that the one set of duplicate spare parts is all that is necessary for the whole of the auxiliary engine in case of accident. They are also now sole makers of the Silley smokebox door fastenings, and are supplying these for a large number of steamers.

Moncrieff's "Unific" Steam Gauge Glasses.—To withstand the severe working conditions of present-day high-pressure steam boilers, makers of gauge glasses have for some time been faced with the problem of producing a tube that would satisfactorily meet requirements. Some makers, it is true, have contented themselves with manufacture on old lines, and looked rather to the invention and use of gauge glass "protectors" of various forms. In spite of the ingenuity expended on such devices, they are, after all, practically an acknowledgment of deficiency and failure. The production of a gauge glass, thoroughly capable of withstanding the very high steam pressures now common, and at the same time able to resist sudden variations of temperature and corroding influences, has for some considerable time formed the subject of painstaking research by Messrs. John Moncrieff, Ltd., of North British Glass Works, Perth, who for nearly forty years have manufactured the well-known "Perth" gauge glasses. The result of severe and prolonged tests which there is not space here to detail, is that in the shape of "Moncrieff's Unific" a quality of gauge tube has now for some time been on the market which for non-corrosion, reliability under sudden variations of temperature, as well as of sustained high steam pressure, and for general lasting properties under the severest working conditions, is more and more enhancing its reputation. The sale of the "Unific" during 1909, the manufacturers inform us, has been good, and is very steadily increasing, owing to the entire satisfaction it is giving to users.

Bull's Metal Propellers.—Notwithstanding the dullness in most branches of shipping which has prevailed during the past year, the demand for Bull's Metal Propellers—either of the solid form or of separate blades with ordinary or special design of boss—has been maintained. This result, indeed, may be taken as being partly on account of, rather than in spite of, dullness in trade. In non-prosperous times, when economy in every direction has to be followed by shipowners and their superintendents, the claims of these propellers appeal most strongly. The tripling of marine engines to save 20 or 25 per cent. of coal has been found good policy in the past, and in the experience of many shipowners, the substitution of a Bull's Metal Propeller for the ordinary article, which means only a small fraction of the cost of tripling compound engines, is relatively as good. The change effects a saving in fuel of from 10 to 15 per cent., or with the same consumption increases the speed proportionately. Solid Bull's Propellers fitted to numerous vessels within recent years have yielded from ½ to ¾ and 1 knot increase of speed on the same consumption. A notable recent case is that of the Allan Liner *Pretorian*, when a solid Bull's Metal Propeller was substituted for an ordinary loose bladed propeller, the result being an increase of fully ¾ knot to the speed with a somewhat reduced consumption. This was the largest solid bronze propeller fitted to any steamer up to that date, being 19 ft. 6 in. in diameter and 11½ tons weight. In order to execute repairs to bronze propellers in the most expeditious and careful manner, Bull's Metal Company have fitted a furnace sufficiently large to give room for the whole propeller blade up to the flange or boss. The blade under repair is slowly brought up to a red heat in this furnace, and thereafter straightened and found to correct shape and pitch by squeezing, wedging or screwing, without hammering. A recent repair of this kind was made to three badly damaged blades of an ocean liner, which vessel subsequently made a record passage with these repaired blades. That dispatch in executing repairs is a matter on which this Company justifiably may pride themselves is borne out by the following instance. In November last, the owners of the Allan liner *Grampian* required a new bronze blade, but could only allow four days for the complete work. Bull's Metal Company received the pattern on Tuesday at 3 p.m., and by 3 a.m. on Saturday they had the heavy blade completed ready for the boss. The work naturally included moulding of the blade, drying of the mould, pouring same, cooling the casting without artificial means, detaching deadhead, removing 3½ cwts. of metal in turning, facing, drilling and scooping out centre, as well as finishing off edges and dressing of surfaces. Six hours were lost by small accidents and stoppages. It is believed that this repair easily breaks all records of the same kind.

DUTCH.

Arnhemsche Stoomsleephelling Maatschappij, Arnhem.—13 ships with 24 engines completed, totaling 2,425 tons disp. and 5,070 I.H.P. respectively.

Koninklijke Maatschappij "De Schelde" Scheepsbouw en Werktuigenfabriek, have completed the engines for the Mail Steamers Frisia and Tambora, in addition to other work set out elsewhere.

W. F. Stoll & Zoon, Alkmaar.

14 Steel Motor Boats aggregating 210 tons and 10 smaller boats, together 55 tons.

AMERICAN.

Fore River Shipbuilding Co., Quincy, Mass.—In addition to vessels launched in 1909, we have received a chart showing 51 vessels contracted for and completed from 1903 to the end of 1908.

The Moran Company, Seattle, Washington, have completed during the year repair work to the extent 1,550 gross tons.

U.S. Navy Yard, Portsmouth, New Hampshire.—U.S. Tug, Patapsco, 2 Pole Masts, steel, displacement normal 755 tons, 1,160 I.H.P., twin-screw.

J. Davidson, West Bay City, Michigan, have built a couple of Dump Scows, but are now devoting entire time to dry docking, rebuilding and repairing wooden ships.

AUSTRALIAN.

Walkers, Ltd., Maryborough, Queensland, have completed a considerable amount of repair work, but have not launched any new vessels.

WORK ON HAND IN BRITISH YARDS.

ENGLISH.

The Shields Engineering and Dry Dock Co., Ltd., North Shields. Totalling 3,005 I.H.P.

Hepple & Co., Ltd., South Shields. Nos. [illegible] and 604, Barges; No. [illegible], Waterboat, No. 606, Icebreaker; all steel.

W. Harkess & Son, Ltd., Middlesbrough. Two vessels of 1000 tons deadweight each.

S. P. Austin & Son, Ltd., Sunderland. Their Docks are at present occupied by steamers undergoing damage repairs, and they have alongside repairing quay a London-owned steamer undergoing damage repairs and passing special survey. Vessels are coming shortly for survey repairs and examination. Immediate outlook is favourable for repair work.

Routh & Waddingham, Winteringham, have one new river vessel building, to be launched early in the New Year.

Beaching Bros., Ltd., Great Yarmouth.

Name of Vessel.	[illegible]	G.T. Regs.	G.T. [illegible]	I.H.P.
Three Drifters [illegible]				

Crabtree & Co., Ltd., Great Yarmouth.—Seven compound engines of 1,400 I.H.P.

G. Rennie & Co., Greenwich.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Tunnel Tug, 1107	Steel	Abroad		—	—
* Tug Boat, 1108	,,	British	—	—	—
Barges, 1109-14		,,	—	—	—

Rowhedge Iron Works Co., Ltd., Rowhedge, Colchester.

No. 55, 35 ft. (teak) Admiralty cutter for battleship Newcastle	—	—	—	—	—
No. 56, Do., Liverpool	—	—	—	—	—
No. 64, 40 ft. Launch Tug, for export	—	—	5	—	22

George & Thomas Smith, Ltd., Rock Channel Shipyard, Rye, Sussex.—No new work, but a coasting Barge repairing.

Camper & Nicholson, Ltd., Gosport.

† No. 189 (Steam Yacht)	Wood	British	40	—	250
mNo. 190 (Yacht)	Composite	,,	130	—	120
mNo. 191 (Yacht)		,,	140	—	80

R. Cock & Sons, Ltd., Appledore.—Two steel Barges.

Philip & Son, Ltd., Dartmouth.

2 Steel Screw Tugs	—	British	220ea	—	—
Wood Steam Pinnaces	—	,,	12	—	160
,, ,, Tug	—	—	20	—	100
* Steel Screw Steamer		—	—	—	200
Triple expansion and compound engines	—	—	—	—	380

John I. Thornycroft & Co., Ltd., Southampton.—Five ocean-going Destroyers for the British Admiralty. One mine-laying vessel for the Portuguese Government. One large shallow draught Tugboat for Russia, also a number of motor boats. Also considerable orders for boilers, auxiliary machinery, etc., for Foreign Clients.

J. Samuel White & Co., Ltd., E. Cowes.

Torpedo Boat Destroyers and other Craft	3,905	53,580

Edward Hayes, Stony Stratford.—Two 50 ft. steel Tugs, one 60 ft. twin shallow draught steamer, several sets of machinery for similar craft; new condensing plant.

Isaac J. Abdela & Mitchell, Ltd., Brimscombe, nr. Stroud.—Work in progress 4 steam crafts, 3 Lighters, several sets of machinery.

W. J. Yarwood & Sons, Northwich, Cheshire.

* No. 138, Screw Coasting Type	Steel	—	240	—	250
No. 140, 2 A and B, Steam Tugs	,,		63ea	—	100
mNo. 141, Tug	,,	—	43	—	30
No. 143, Steel Derrick Vessel	,,	British	5	—	8

Lytham Shipbuilding and Engineering Co., Lytham, Ltd., Lancs.—Twin-screw cargo steamer and single-screw steam barge.

H.M. Dockyard, Portsmouth.—Completing the new 1st-class battleship St. Vincent. Building the Orun, 1st-class battleship on the slip; carrying out an extensive refit on H.M.S. Prince George and smaller refits to many others of H.M.S. ships.

H. M. Dockyard, Pembroke.

Building.					
H.M.S. Blonde	Steel	—	3,350	—	18,000
Repairing.					
† H.M.S. Antelope	,,	—	810	—	3,500
† H.M.S. Osprey	,,	—	355	—	6,000
† H.M.S. Sylvia	,,	—	350	—	5,400

John Chambers, North Side of Harbour, Lowestoft.—Fifteen vessels (approx. total tonnage, 900 tons).

ENGINES.

A. B. Collis, Ltd., Bitterne Park, Southampton.—One set of compound surface-condensing engines, and several sets of various size liquid fuel machinery.

Hepple & Co., Ltd., South Shields.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* Mary Blake	Hepple & Co., Ltd.	320	130
* No. 605	,, ,,	200	130
* No. 606	,, ,,	—	—

C. D. Holmes & Co., Ltd., Hull.—Three or four sets of machinery.

Mersey Engine Works Co., Ltd., Liverpool.—Three proposed vessels, 2 sets C.S.C. engines, 1 set C.S.C. engines, 2 sets C.S.C. engines.

Plenty & Sons, Ltd., Newbury, Berks.

* ———	300	120
† ———	500	180

Sisson & Co., Ltd., Gloucester.

‡‡Cargo steamer for Lydney	E. Finch & Co., Ltd., Chepstow	250	120

The Vauxhall & West Hydraulic Engineering Co., Ltd., Luton, Beds.

‡‡2 Single-screw Tugs	Foreign	210ea	160ea
‡‡Twin-screw	British	450	120
‡‡Single-screw Tug	,,	130	120
‡‡S. Passenger Launch	,,	80	130
‡‡Twin-screw	Foreign	80	130
† Triple Mill Engine	British	400	200
‡‡Single-screw Launch	Foreign	30	120
	Total	1,590	

† Triple. * Compound. m Motor. t Turbine.
‡‡ Compound Surface Condensing.

W. & F. Wills, Ltd., Bridgwater.

	I.H.P.	Press. lbs.
* Eroder for Bridgwater Corporation, hull by Finch and Co., Ltd., Chepstow, engines and eroding plant by W. & F. Wills, Ltd.	195	340
Eroder for York Ouse Navigation, Hull and propelling machinery by Hepple & Co., Ltd., South Shields, Eroding plant by W. & F. Wills, Ltd.	110	160

SCOTCH.

The Ailsa Shipbuilding Co., Ltd., Troon and Ayr.—One passenger steamer of 1,850 tons for Brazil, one passenger ferry steamer of about 400 tons for Birkenhead Corporation, 1 cargo steamer of about 1,450 tons for the General Steam Navigation Co., Ltd.

Alley & MacLelland, Polmadie, Glasgow.—Twenty-four vessels of total gross tons, 1900.

George Brown & Co., Greenock.—About 300 tons gross.

Fleming & Ferguson, Ltd., Paisley, N.B.—Two vessels of 1,200 gross tons' 1,400 I.H.P.

London and Glasgow Engineering and Iron Shipbuilding Co., Ltd., Glasgow.—One Torpedo Boat Destroyer and one Cruiser of Bristol class for British Admiralty.

Peter McGregor & Sons, Kirkintilloch, Glasgow.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
1 Tug	Steel	—	30	—	150

Murdoch & Murray, Port Glasgow.—Work on hand, 600 tons.

Ritchie, Graham & Milne, Whiteinch, N.B.—Fifteen steel Cargo Barges, about 1,250 tons gross.

A. Robertson & Co., Sandbank, Argyllshire.—Fifteen metre Racing Cutter.

Ross & Duncan, Glasgow.—Fifteen sets of 5,500 horse power.

Scott & Sons, Bowling, nr. Glasgow.—Three steamers of 1,120 tons.

John Cran & Co., Leith, N.B.

Beyond considerable Survey and Repair work, they have in their yard under construction: Two Pilot Cutters for Trinity House, with Motor Auxiliary Machinery; also a Steel Tug of 240 H P. for Russia.

Hawthorns & Co., Limited, Leith, have at present under construction three vessels of an aggregate tonnage of about 500, and 1,100 I H.P.

In addition to the Inchcolm launched, they have built for Spanish owners 2 sets of marine engines of 250 I.H.P. each. They have also carried out a considerable number of extensive overhauls and repairs, and constructed a number of marine and land boilers. Throughout the year work has been quiet at both their Leith and Granton establishments.

J. Weatherhead, Eyemouth.—A few motor engines to fix as auxiliary power to sailing fishing boats, and one large Round-Stern Coble or Mule for fishing on the Northumberland Coast.

The Caledon Shipbuilding and Engineering Co., Ltd., Dundee.

* No. 211, P.S. Steam Ferry Boat	Steel	British	280	—	500
† No. 213, S.S., Steam	,,		1,112	—	1,200
† No. 214, S.S., Steam	,,	,,	1,808	—	6,000
* No. 215, S.S., Steam Crane Steamer	,,	,,	110	—	250

Alexander Hall & Co., Ltd., Aberdeen.

1 Steam Drifter	—	—	88	—	235
1 Cargo Steamer		—	400	—	500
1 ,, ,,	—	—	300	—	380
1 Salvage Steamer	—	—	110	—	240
1 Steam Trawler	—	—	180	—	375

ENGINES.

Bow, McLachlan & Co., Ltd., Paisley.—Marine engines built, total I.H.P. 8,600.

Fishers, Ltd., Paisley.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† Name not known	Scott & Sons, Bowling	380	160
‡‡Nos. 218 and 220, Names not known	,, ,, ,,	300 ea	135ea
‡‡No. 214, name not known	J. Fullerton & Co.	400	130
‡‡Tug No. 45, name not known	P. McGregor & Sons	140	120
	Total	1,520	

Ross & Duncan, Govan.—15 sets of 5,500 H.P. in hand.

John G. Kincaid & Co., Ltd., Clyde Foundry, Greenock.—4 sets of Marine Engines.

W. V. V. Lidgerwood, Whifflet, Coalbridge.—7 sets of Triples.

Menzies & Co., Ltd., Leith.

* 1 Vessel	180	130

Miller & Macfie, Ltd., Glasgow, have plenty of work on hand.

S. & H. Morton & Co., Victoria Dock, Leith.—16 Horizontal Steam Cargo Winches, Cylinders 7 in. by 10 in., 4 fitted with extended ends, to order of Messrs. James Currie & Co., Leith. 1 Marine Type Boiler, to order of Messrs. Caldwell & Co., Inverkeithing.

IRISH.

Dublin Dockyard Co., North Wall, Dublin.—Two steamers and one sailing vessel building with a gross tonnage of about 980 tons and an I.H.P. of about 850.

†* Triple Compound. * Compound. † Triple.
‡‡ Compound Surface Condensing.

Harland & Wolff, Ltd., Belfast.—Three of their slips in the North Yard have been unproductive, being in course of conversion into two and equipment with the special appliances required in building the gigantic steamers Olympic and Titanic for the White Star Line, which are now under construction.

The Larne Shipbuilding Co., Larne Harbour, Ireland.—One Barge, 50 tons register.

ENGINES.

MacColl & Co., Ltd., Abercorn Basin, Belfast.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† Tenet	Workman, Clark & Co.	600	180
† Chemainus	Dublin Dockyard Co.	700	185

WORK ON HAND IN FOREIGN YARDS.

FRENCH.

Chantiers de l'Atlantique, St. Nazaire.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P
France	—	Havre	—	—	45,000

Forges et Chantiers de France, Dunkirk, have tonnage in hand aggregating 12,000.

Schneider & Co., Creusot.

p 9-82	—	—	555T	—	1,700
t Boutefeu	—	—	714T	—	14,000
p S.S. 1	—	—	300T	—	720

Societe Anon Des Chantiers et Ateliers de Normandie, Grand Quevilly, Rouen, have in hand 1 Torpedo-Boat Destroyer for the French Navy, 1 Oil-Carrying Steamer of 3,600 tons; 2 Steam Liners of 4,200 tons each.

Societe Anonyme des Chantiers de St. Nazaire, Penhoet.

t France, Steam Packet	—	Le Havre	22,500	—	45,000
Engines for:—					
t Mirabeau, Battleship	—	—	—	—	22,500
Condorcet, Battleship	—	—	—	—	22,500
Tanissarn, Torpedo-boat Destroyer	—	—	—	—	9,000
† Radioleim, Cargo	—	—	—	—	2,250
† 2 Peruvian Steam Packets	—	—	—	—	7,200

ENGINES.

J. & A. Niclausse, Paris.

Name of Vessel.	Builders	I.H.P.	Press. kgs.
Croiseur turc	Ansaldo	12,500	17

Fitted with Niclausse Boilers.

BELGIAN.

Antwerp Engineering Co., Antwerp.

2 Steamers of 2,000 and 2,300 tons d.w., and 800 and 850 I.H.P. respectively; and 1 Sternwhaler of 20 tons d.w. and 70 I.H.P.

Aug. Hamman, Ostend.

2 Trawling Fishing Smacks, about 50 and 30 tons register each.

Societe Anon. John Cockerill, Hoboken.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
t 2 Turbine Packet Boats, 3 screws	Steel	Ostend	2,960ea	..	13,000
‡ 499, Stern Wheel	,,	Congo	160	—	150
* 500, ,,	,,	,,	1,413	—	500
2 Barges, Bull-Dog Type	,,	Belgium	110ea	—	—

GERMAN.

Blohm & Voss, Hamburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Prinzess Eitel Friedrich (Training Ship)	Steel	Oldenburg	about 1,600		—
Von der Tann, large Cruiser for the German Navy					
G. ,, ,, ,, ,,					
H. ,, ,, ,, ,,					
Steamer	Steel	Hamburg	about 7,100		abt 6,000
,,	,,	,,	,, 6,000		.. 3,100

Heinrich Brandenburg, Hamburg.

* No. 229, Tug	Steel	—	—	27	80
* No. 230, ,,	,,	—	—	32	150
* No. 230, Steam Launch	Wood	—	—	7	18
* Nos. 238-243, 3 Steam Launches	Wood	—	—	7ea	18ea

Bremer Vulcan, Schiffbau und Maschinenfabrik, Vegesack.

† Edmund—Hugo Stinnes 4	Steel	Mulheim-Rulve	2,700	—	1,700
† Clare—Hugo Stinnes 1; Nora—Hugo Stinnes 2	..	,,	4,950ea	—	1,700ea
a S.S. 535	..	Hamburg	5,350	—	3,000
† ,, 536	..	Bremen	250	—	600

Flensburger Schiffsbau Gesellschaft.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Rendsburg and No. 289	Steel	Hamburg	4,000ea	—	3,000ea
Nos. 295 and 296	,,	Flensburg	100ea	—	175ea
Fritz—Hugo Stinnes 5; Annie—Hugo Stinnes 6	,,	Mulheim	1,400ea	—	850ea
No. 299	,,	Flensburg	1,100	—	650
No. 300 (Sail)	,,	,,	150	—	—
No. 301	,,	—	2,200	—	1,400
No. 302	,,	Flensburg	200	—	—
		Total	16,030		10,100

Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden.

† Posen, Battleship	Steel	Wilhelmshaven	18,800		20,000
t Coln, Cruiser	,,	Kiel	4,350	—	20,000
† S. 164, Ore-steamer	,,	Rotterdam	3,650 gr. t.		1,000
t G. 174/75, Torpedo-Boats	..	Kiel	650ea	—	12,000
S. 156, Motor boat	,,	,,	—	—	—

T. G. Hitzler, Lauenburg (Elbe).

S. 228, 230, 231, 232, Tug-boats	Steel	—	—	400ea	—
m S. 233 and 234, Motorboats	,,	—	—	—	36

R. Holtz, Harburg (Elbe).

2 Sternwheelers	Steel	Foreign	—	54	125
1 Steamboat	,,	,,	—	7	20
4 Motorboats	,,	,,	—	25	40eff
2 Lighters	,,	,,	—	20	—

Howaldtswerke, Kiel.

1 Battleship	—	—	—	—	—
2 Cargo Steamers	—	—	—	970	750
2 Pontoons	—	—	—	550	120
1 Dredger	—	—	—	410	350
1 Floating Dock	—	—	—	30,035	—

J. W. Klawitter, Danzig, Germany.

* S. No. 348	Steel	Tilsit	110	—	230
† S. No. 350	,,	Danzig	305	425	1,000 (2 at 500)

J. L. Meyer, Papenberg.

* Yard No. 245	Steel	—	—	27	50
* ,, 246	,,	—	—	50	150
m ,, 247	,,	—	—	85	20

"Neptun," Actien. Ges., Rostock.

† Nos. 299, 301, 302, 303, 4 Steamships	Steel	Hamburg	—	500ea	550ea
† Nos. 300, 304, 2 Steamships	..	..	—	3,200ea	1,100ea
† No. 305	,,	..	—	5,000	2,000
* No. 206	,,	Rostock	—	120	250

Reiherstieg Schiffswerft und Maschinenfabrik, Hamburg.

† No. 428, Hamm, Schooner	Steel	Hamburg	—	4,050	3,000
a No. 429, Schooner	..	..		3,900	1,450

Rickmers, Reismuhlen, Rhederei & Schiffbau A. G., Bremerhaven.

† SS. Nos. 158, 159, 160	Steel	Bremerhaven	4,104ea	—	1,600ea

Gebr. Sachsenberg, Rosslau-on-Elbe.

* Herkules and Goliath	Iron	Kiel	520ea	—	400ea
† Gebr. Dörtelmann	..	Duisburg	600	—	1,100
* Name unknown	,,	Koln	635	—	700
† Bertold	,,	Breslau	288	—	500
†* Name unknown	..	Mannheim	320	—	1,210
† Carolus	..	Hamburg	253	—	320
Brunhilde	..	Halle a. S	75	—	110
† Name unknown	..	Hamburg	253	—	320

Schiffswerte und Maschinenfabrik Vorm. Janssen and Schmilinski Act Ges., Hamburg.

* Tiger	Steel	Altona	42	—	200

G. Seebeck Act. Ges., Bremerhaven.

† Nos. 295 and 296, Trawlers	—	Gustimunde		200	320
* No. 298, Dredger	—	Buenos Ayres	—	140	100

H. C. Stulcken & Sohn, Hamburg.

No. 366, Steam Launch	Wood	Abroad	—	[illegible]	16
No. 384, Tow-boat	Steel	Hamburg		41	170
† Senator Michahelles, Fishing Steamer	..	Cuxhaven		[illegible]	400
396-400 (2 vessels)					
† Fishing Steamer	..	Abroad		[illegible]	100
* No. 401, Steam Launch	..	Hamburg		21	[illegible]
* No. 402,	..	Abroad		42	120

Stettiner Maschinenbau Act. Ges., "Vulcan," Stettin-Brebow.

t V. 180-185, Torpedo-boat	Steel	Kiel		[illegible]	10,000
* Box, Ferry Boat	..	Stettin		[illegible]	[illegible]
† No. 302, Cruiser	Steel	Montevideo		1,000	8,000
† No. 303, for Coal Freight	..	Stettin		[illegible]	1,100
t No. 310, Ers. Heimdall, Battleship		Kiel	—	[illegible]	[illegible]
* No. 311, Ferry Boat		[illegible]		54	90
† Rheinland, Battleship		Kiel		[illegible]	24,000

Stettiner Oderwerke, Stettin.

† Nos. 613 and 614	Steel	Stettin	620ea		400ea
† No. 615	..	..	[illegible]	—	1,100
† No. 616			1,128		700
† No. 617		Emden	312		200
† No. 618		Hamburg	576	—	[illegible]

a Quadruple. p Petrol. t Turbine, * Compound. † Triple. ‡ High Pressure.

a Quadruple m Motor t Turbine * Compound. † Triple. †* Triple Compound.

Stocks & Kolbe, Kiel.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Yard No. 151	Steel	Flensburg		65	110
* ,, 153	,,	Montevideo		12	40
* ,, 154 ..	,,	,,		12	40

Joh. C. Tecklenborg Act. Ges., Geestemunde.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† SS. 226	Steel	Bremen	5,650		3,000
a SS. 235	,,	,,	6,000		3,000
a SS. 236	,,	,,	6,000		3,000
a SS. 237	,,	,,	6,000		3,000
			23,650		12,000

Joh. Thormahlen Co., Elmshorn.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
1 Schooner ..	Steel	Elmshorn	120		
6 Lighters ..	,,	Hamburg	780 (total)		

"Weser" Actien Gesellschaft, Gropilingen, Bremen.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Steamers, Nos. 167, 168, 169, 170	Steel	Bremen		651ea	350ea
Yard No. 381, Pontoon ..	,,	,,		37	—

J. H. W. Wichhorst, Hamburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* SS 236	Steel	Bremen	18		60
* SS 237, 238, 239	,,	Hamburg	80ea		260ea

Gebr. Maass, Neustrelitz, Meckenburg, have work on hand totalling 171 gross tons.

AUSTRIAN.

Austrian Lloyd's Steam Navigation Co., Trieste.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Stambul (No. 120), and No. 121 (2 Masts)	Steel	Trieste	—	3,820ea	2,500ea
t T.S.S. Wein and Helouan (2 Masts)	,,	,,	—	7,120ea	10,000ea

Stabilimento Tecnico, Trieste, Austria.—Three battleships of 14,500 tons displacement and 20,000 I.H.P. each; two torpedo boats of 110 tons displacement and 2,300 I.H.P. each; twelve oil lighters and twelve other vessels; one turbine plant of 20,000 I.H.P. for cruiser Admiral Spaun.

DUTCH.

Arnhemsche Stoomsleephelling Maatschappij, Arnhem.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
12 Ships (11 Tugs)	—	—	1,350 dis.	—	3,000

G. & H. Bodewes, Martenshoek.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Antonina Frater and Jac. Frater, Tugs ..	—	Groningen	—		250
† Geertruida	—	,,	—		175
† Tug	—	,,	—		140
† Zeeland	—	Dordrecht	—		160
* Tug	—	—	—		225
4 Sailing Vessels ..	—	Germany	100ea		
Motor Launch	—	Holland	—		—

H. H. Bodewes, Millingen.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
K S 35 and 36	Steel	Duisburg	1,700		
K S 37	,,	,,	900		

Firma Wed. C. Boele & Zonen, Slikkerveer bij Rotterdam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Lighter	—	Rotterdam	—	2,000	—

Bonn & Mees, Rotterdam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Bandoeng	Steel	Rotterdam	5,000	—	2,400

Gebr. Boot, Leiderdorp.

Yard "De Hoop."

In hand, 3 Tugs, 2 Motor Yachts, 3 Motor Sail Luggers, 2 Motor Boats, and Steam Passenger Boat.

Yard "De Waard."

9 Vessels in hand, including Tugs and Motor Boats.

The Fijenoord Co., Rotterdam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Van Waerwyck	Steel	Batavia	2,000		1,000
† No. 233 (hydrogrs service)	,,	Dutch Govt.			300
No. 234, Lightship ..	,,	,,			—
† Nos. 235 and 236, Cargo and Passenger Steamer	,,	Batavia	1,715ea		1,100ea

Koninklijke Nederlandsche Grotsmedery, Leyden.

One Suction Dredger

Koninklijke Maatschappij "De Schelde" Scheepsbouw en Werktuigen-fabriek.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
SS Sophie H, Cargo Steamer (Isherwood system)		Rotterdam	2,300		1,300
S.S. No. 133, Submarine	—	Dutch Govt.	140dis		445
T.S. Nos. 134 and 135, Torpedo-boat Destroyers	—	,,	0485 ..		8,000ea

Name of Vessel	Builders	I.H.P.
† Bandoeng (engines only)	Bonn & Mees, Rotterdam	1,300
† Tjitaroem (engines only)	Ned. Scheepsbouw Maat. Amsterdam	2,800

K. J. Koopman, Dordrecht.

2 Steel Tugs of 465 tons.

N. V. Scheepsbouwwerf "Baanhoek," voorheen T. Nederlot.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
1 Boat for the Rhine	—	—	600		

Nederlandsche Scheepsbouw-Maatschappij, Amsterdam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Van Linschoten	Steel	Batavia	3,000		1,500
a Prinses Juliana	,,	Amsterdam	8,400		5,500
† Tjitaroem ..	,,	Batavia	7,800		2,800
† Not yet named	,,	Amsterdam	250		350
a Not yet named	,,	,,	8,400		5,500

* Compound. a Quadruple. † Triple.

Gebr. Pot, Ridderkerk.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Name unknown	—	Rotterdam	600	—	—
Name unknown	—	,,	760	—	—
* Maria Hendrika II, Cor II., Maria II.		England	110ea	—	165ea
* Name unknown		,,	200	—	700

Scheepswerf Vorheen Jan Smit Co., Alblasserdam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Ryswyk, Cargo Steamer	Steel	Rotterdam	—	1,600	900

E. J. Smit & Zoon, Hoogezand.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
469, Schooner	Steel	Groningen	175		
470, Lighter	—	Hamburg	300		
* 472, Prinses Juliana, Cargo Steamer ..		Groningen	130	-	200
474, Sailing		—	50		
476 and 477, Lighters ..	Steel	—	250ea		

Firma A. F. Smulders, Schiedam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* 330, Bucket Dredger			320		200
* 344, Suction Dredger			300		450
* 370, Tirreno, Bucket Dredger			600		700
* 372 and 375, Bucket Dredgers			300ea		350ea
* 380, Bucket Dredger			700		900
* 383, Suction Dredger			300		600
* 392, Bucket Dredger			750		700
* 393, Tug			100		150
394, Floating Workshop			40		—
* 395, Floating Elevator			160		200

W. F. Stoll & Zoon, Alkmaar.

7 Steel Motor Launches, 1 Passenger Steamer, steel, and 1 Rowing boat.

Van Vliet & Co., Hardinxveld.

2 Cargo Steamers for London aggregating 1,850 tons, and 2 Lighters amounting to 4,100 tons, one for Rotterdam; all of steel.

A. Vuijk & Zonen, Capello a.d. Yssel, near Rotterdam.

Boomberg steamer to complete.

Steamer ordered for Copenhagen account, gross tonnage about 1,370. And further in full contracted for next year's supply 5 Lighters of about 6,000 tons of 100 kilo carrying capacity. To be built of steel.

Werf Conrad, Ltd., Haarlem.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* No. 409, Tin Dredger ..		N.N.	350		155
† No. 411, Hopper Suction Dredger		Punta de Indio	2,500		2,000
* Bromo, Dredger	-	Tandjong Priok	700		600
* Sindoro, Dredger	—	Soerabaja	280	-	165

Wilton's Engineering & Slipway Co., Rotterdam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Prinses Juliana	Steel	Holland	550	660	300
† Wurtemberg	,,	,,	600	260	480
* Engineering	,,	,,	75	85	250
† Donau ..	,,	,,	250	480	500
* 2 Elevators	,,	,,	370ea	540ea	250ea

Wortelboer & Co., Hoogezand.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Nos. 47 and 48	Steel	—	400ea		

ENGINES.

Alblasserdamsche Machinefabriek, Alblasserdam.

Name of Vessel.	Builders.	I.H.P.	lbs. Press.
* William Egan, 27, 28, 29, 30, 31, 32	Jonker & Stans	300ea	165ea
† Berichon	(Old ship)	200	200

Kinderdijk Machinefabriek, Kinderdijk.

Name of Vessel.	Builders.	I.H.P.	lbs. Press.
* Name unknown	T. & K. Smit's Scheepswerven	200	120
† Bayern ..	,, ,, ,,	900	195
* Name unknown	,, ,, ,,	400	105

Lohnis & Co., Rotterdam.

Name of Vessel.	Builders.	I.H.P.	lbs. Press.
T.S. Stompwijk	Boele & Pot	350	120 superheated
† No. 162	,,	225	185
† No. 163	,,	225	185
* No. 164	T. K. Smit	80	105

Netherlands Engineering Co., Amsterdam.

Name of Vessel.	Builders.	I.H.P.	lbs. Press.
† Van Linschoten	Nederl. Scheepsbouw Mij.	1,450	180
† Zeven Provincien	Naval Yard	7,500	250
† Name unknown	Nederl. Scheepsbouw Mij.	480	160
a Prinses Juliana	,, ,, ,,	6,600	210
a Name unknown	,, ,, ,,	6,600	210

Wilton's Engineering & Slipway Co., Rotterdam.

Name of Vessel.	Builders.	I.H.P.	lbs. Press.
† Fiat Voluntas, 13	Duyvendyk Papendrecht ..	650	200

Also 7 Boilers, with a total heating surface of 12,500 sq. ft.

NORWEGIAN.

Akers Mekaniske Verkstad, Christiania.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† No. 287, Sch.	Steel	Christiania		1,550	1100
† No. 288, Sch.	,,	Bergen		200	350
† No. 289, 291, Sch.	,,	Mem		600ea	450ea
† No. 290, Whaler	,,	Wictoria		100	375
Nos. 292, 293, 294, Whalers	,,	Leith		106ea	375ea

Christiansand Mekaniske Verksted, Christiansand.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† s.s. Tintos	Steel	Skien		200	250
† s.s. Tin	,,	Telemarken		200	250

A/S Laxevaags Maskin & Jernskibsbyggeri, Bergen.

Name of Vessel.	Builders.	I.H.P.	lbs. Press.
† s.s. Nos. 97, 98.	A/S Laxevaags, Maskin & Jernskibsbyggeri	650ea	175ea

* Compound. † Triple. a Quadruple.

Framnæs Mekaniske Verkstad, Sande.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Whaler	Steel	—	124ab	..	300

Steel Floating Dock of 5,000 tons lifting power.

Nylands Værksted, Christiania.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† No. 203, Passenger Cargo	Steel	Christiania	—	1,400	1,100
† No. 204 ,,	..	Drontheim		320	350
* No 205, Lighter..	,,	Christiania	—	14	35
† No. 206, Whaler	,,	Iceland	—	120	350
† No. 207 ,, ...	,,	Tonsberg		110	280
† No. 208, Cargo Steamer ..	,,	Christiania	—	1,000	900

Trondhjems Mek. Værkstad, Trondhjem, Norway.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† s.s. 141	Steel	Trondhjem	1,400	—	900
† s.s. 142	,,	,,	480		500
† s.s. 143	,,	,,	1,100		900

SWEDISH.

Bergsunds Meckaniska Verkstads Aktiebolag, Stockholm.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† 4 Torpedo-boats		Swedish Navy	110ea		1,900ea
* 1 Tug Boat.. ..		Russian	—		12[illegible]

Eriksbergs Mek. Verkstad Aktiebolag, Gothenburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* S.S. 148 ..	Steel	Veile, Denmk.	—	70	60
* S.S. 149	..	Karlskrona		175	27[illegible]
* S.S. 150	..	Stockholm		210	72[illegible]

Goteborgs Nya Verkstads Aktiebolag, Gothenburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
S.S. 312, Destroyer		R.S.N.	4000 dis		5,500
and 3 Motor Boats ..			—		—

Kockums Mekaniska Verkstads Aktiebolag, Malmo.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Minnin, Tor.-boat Destroyer	—	Stockholm	—		7,200

Motala Verkstads Nya Aktiebolag, Motala.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
p Water-Cargo Vessel	Steel	Stockholm			60eff
* Cargo steamer ..	..	Motala			130

DANISH.

Atkieselskabet Burmeister & Wains, Maskin-og. Skibsbyggeri, Copenhagen.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† s.s. Nos. 272 & 273, Cargo and Passenger St.	Steel	Danish		2,400ea	1,100ea

The yard has also been engaged with sundry repair work.

H. V. Buhl & Co., Frederikshavns.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
p 1 Steel Vessel .	Steel	—	150		45B.H.P.

Copenhagen Floating Dock & Shipworks, Ltd., Copenhagen.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Cargo and Passenger Steamer	Steel Schooner	Copenhagen	830ab		950
Cargo Steamer ..		Korsör	1,325ab		625
m Motor Dredger ..		—	20		25

Actieselskabet Helsingors Jernskibs-og. Maskinbyggeri, Elsinore

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Yard No. 123	Steel	Unfixed	1,672ab		700
125	.	Copenhagen	475		[illegible]
126	..	..	475		[illegible]
,, 127	.	..	650		900

RUSSIAN.

Societe Anonyme Chantiers Navals, Ateliers et Fonderies de Nicolaieff, Nicolaieff.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
No. 85 Submarine. Particulars cannot be given.					
No. 67 Dredger (bucket and suction	Steel	Dniepre	160	—	1 eng. 7[illegible] 1 .. [illegible]

T. R. Eales & Son, St. Petersburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Vnouk, Tug .	Steel	St. Petersburg	50dis		100
* Samoed, Tug .		..	80dis		240

ITALIAN.

Amerigo Gori, Leghorn. Caprera, Steel Ferry Boat, 1,70[illegible] tons, plating done. Maria, Wood Schooner, 182 tons, the keel has been laid.

Ditta Giovanni Poli, Chioggia. [illegible]0 Steel Barges for the Royal Italian Navy, total tons 2,000.

Gio. Ansaldo Armstrong et Cia, Sestri-Ponenti.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† No. 156, Protect. Cruiser .	Steel	Constantinople		2,000	12,[illegible]
t No. 157, S.S. Catania .	..	Naples		[illegible],100	12,000

Oders, Nicolo & Co., Sestri-Ponenti, has one Steamship, [illegible] tons register for Italian Railway, for voyaging from Italy to Sicily, 22 knots, 13,000 I.H.P., on hand.

Societa Esercizio Bacini, Genoa.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† S.S. Maddalena	Steel		2,1[illegible]		[illegible]
† S.S. Mokara			[illegible]		[illegible]

* Compound. † Triple p Petrol. m Motor. t Turbine.

SPANISH.

Compania Euskalduna de Construccion y Reparacion de Buques, Bilbao.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
S.S. Bizkargi-mendi, Schooner, single deck ..	Steel	Bilbao	—	3,100	—

AMERICAN.

T. Adair, East Boothbay, are building several launches.

The American Car & Foundry Co., Wilmington.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Nos. 43 and 44 .	—	Philadelphia	700ea	—	

Wm. Cramp & Sons, Ship & Engine Building Co., Philadelphia.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
t John Mayrant, Lewis Warrington, T.P.D. [illegible], Torpedo-boat Destroyers ..	Steel	U.S. Navy		742 dis	12,000
t U.S.S. Wyoming, Battleship .				26,000 .	28,000
† Cyclops, Collier ..				19,360	7,200

Electric Launch Co., Bayonne.

Two 98 ft. Gasolene Cruising Yachts.
Two 54 ft. Gasolene Yachts.
One 57 ft. Gasolene Yacht.

W. A. Fletcher & Co., Hoboken, N.Y.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
** Utica, Steel Screw Ferryboat (screw at each end)		New York	1,400		1,000
Princeton, Paddle Steamer		.	4,500		4,500
New Steamer, Lake George St. Bt. Co., Paddle .		Lake George	650		1,400

Fore River Shipbuilding Co., Quincy, Mass.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Salmon Submarine		U.S. Navy	[illegible]37 dis		
2 Destroyers			ea742 ..		
2 Submarines					
Torpedo-boat Destroyer Walke . ..			742 ..		

Harlan & Hollingsworth Corporation, Wilmington, Delaware.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Northland Pas. & Fgt	Steel	Portland, Me.	[illegible]	4,210	4,000

Maryland Steel Co., Sparrows Point, Maryland.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
a No. 104	Steel	New York		6,100	3,000
a No. 105				6,100	3,000
a No. 106				6,100	4,000
No. 107				2,000	1,500
† No. 108				10,000	7,000

The Moran Company, Seattle, Washington. Building 2 U.S.N. Submarine Torpedo-boats, 1 Steel Cargo Steamer, 1,838 gross tons.

Newport News Shipbuilding & Dry Docks Co., Newport News, Virginia.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Seal, Submarine, Lake type		U.S. Navy			
Tuna, Submarine, Lake Type		,,			
† City of Montgomery and City of St. Louis, Frt. & Pas...		Savannah		[illegible]000ea	2,[illegible]ea
J. A. Chanslor, Oil Tank .		San Francisco		[illegible],200	2,000
El Sol, El Mundo, El Oriente, El Occidente, Frt ships		New York		[illegible]700ea	[illegible]800ea
Monoghan, Torpedo-boat Destroyer ..		U.S. Navy			
(not named) Frt. Ship		New York		2,500	1,500
(not named) Frt. & Pas.		..		[illegible]700	[illegible]500

New York Shipbuilding Co., Camden, N.J.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
[illegible] Torpedo-boat Destroyers			ea 750 dis		
1 Battleship, Utah ..			21,825 ,,		
1 Battleship, Arkansas			26,000 ,,		
2 Steam Colliers			6,000 d.w.		2,000
1 Coal Barge ..	Steel		2,000 .		
2 Car Floats, Dim. 257 by 40 by 10 ft.					
1 Coal Barge .			2,000		
1 Transfer Barge, Dim. [illegible] by 48 ft. [illegible] in. by 12 ft. 6 in. ..			2,1[illegible] dis		

Southern Pacific Railway Co., Oaklands, Cal. Material is being assembled to construct a Stern Wheel Steamer same as steamer Navajo, mentioned in Launch Section.

Joseph Supple, Portland, Oregon.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Gamecock, Stern Wheel	Wood	Portland	2[illegible]		[illegible]

Thames Tow Boat Co., New London, Conn., are building a barge, [illegible] ft. long, [illegible] ft. beam, 13 ft. depth of hold, to carry about [illegible] tons, that will be completed within the next month.

Union Iron Works Co., San Francisco, Cal.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Napa Valley ..	Steel	Augusta, M[illegible]	[illegible]		2[illegible]

To be launched about February [illegible].

U.S. Navy Yard, Portsmouth, New Hampshire.

U. S. S. Maine, Battleship, refitting, new boilers, etc.

ENGINES.

James Rees & Sons Co., Pittsburg, Pa. [illegible] Set? Capstan.

The Superior Shipbuilding Co., Superior, Wisconsin, [illegible] Freighter about [illegible] trade [illegible] this will [illegible] The [illegible] H.P. and Vertical Sect[illegible]

† Triple. ** Twin Compound. [illegible] t Turbine.

CANADIAN.

Joseph McGill, Shelbourne, N.S.—One wood schooner, 90 tons.

L. D. Schaffner, Bridgetown, Annapolis, N.S.—Vessel of about the same class as in Launch Section.

Toronto Shipyard Co., Toronto.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Steamer, 5	Steel	200 ft. × 37 ft. × 10 ft.			900

AUSTRALIAN.

Morrison & Sinclair, Balmain, N.S.W., have one Ferry Steamer in hand.

Morts Dock and Engineering Co., Ltd., Balmain, Sydney.—Double-ended Steamer of approx. 600 gross tonnage for passenger service, with triple-expansion engines 1,500 I.H.P., 180 lbs. pressure. One set engines for double-ended steamer, building by Morrison & Sinclair, Sydney, 275 I.H.P. 180 lbs. triple.

JAPANESE.

Oaki Shipyard, Tokyo.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
1 Steam Schooner	Wood	Tokyo	—	1,000	850

The hull is still on the building berth, but when completely rigged she will be engaged on the inland sea service for her first voyage. The boat will be able to do 9 knots per hour on very low consumption (8 ton Japanese coal), on account of excellent propeller designed by their engineer.

Ono Shipyard, Osaka, are building two vessels, each 500 tons.

The Osaka Iron Works, Osaka.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Oda, Trawler	Steel	—	—	—	—
† Hayashi, Cargo Boat ..	,,	—	1,010ab	—	—
† Spare boat ,, ..	,,	—	1,010ab	—	—
Shibata, Yacht	Wood	—	—	—	—
E. H. Hunter, Yacht ..	Steel	—	—	—	—
Okurasho, Barge	..	—	—	—	—

The Usago Dock Co., Ltd., Tokyo.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Yard No. 58, Self-propelling Sand Pump Hopper Dredger	Steel	Niigata	—	630	350
* Yard No. 59, Twin-screw Launch	,,	Kobe	—	130	350
† Yard No. 60, Self-propelling Stern Well Hopper Dredger	—	Teuruga	—	250	160

The Mitsu Bishi Dockyard and Engine Works, Nagasaki.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† No. 200 ..	Steel	Osaka	—	6,000	3,900
† No. 201	,,	,,	—	6,000	3,900
† No. 202	,,	,,	—	6,000	3,900
No. 203	,,	Tokyo	—	13,700	16,850
E. No. 207 Destroyer (Parsons Turbines)	—	—	—	—	
No. 208, 2nd-class Cruiser	—	—	—	—	
No. 209, Destroyer	—		—	—	

All to be engined by the Company.

CHINESE.

The Shanghai Dock and Engineering Co., Ltd., Shanghai.—One 1,000 I.H.P. sea-going Tug Boat.

HONG-KONG.

Taikoo Dockyard and Engineering Co., of Hong-Kong, Ltd.

Name of Vessel.	Built of	
† T.S. Steamer (103) . .		235 ft. × 40 ft. × 10 ft.
2 Barges	Steel	110 ft. × 30 ft. × 8 ft.

STRAITS SETTLEMENTS.

Riley, Hargreaves & Co., Ltd., Singapore.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
m No. 257, Motor Lighter .	Wood		60		.2B.H.P.
m No. 258, T.S. Motor Launch ..			44	-	112B.H.P.
* No. 260, Launch		Singapore	13	-	27
m No. 261, Motor Lighter			54	—	32B.H.P.

* Compound. † Triple. m Motor

IN our February issue we shall have pleasure in commenting upon the well-known Hughes Standard Compass, the Endall Night-Signalling Apparatus and the Morsaphore, a combination of Morse lamp and Semaphore in one fitting.

MESSRS. MATTHEW, KEENAN & CO., LTD., of Glasgow and London, have recently completed the work on board the s.s. *Highland Rover*, for Messrs. Rankine & Blackmore, Greenock.

IRON AND STEEL INSTITUTE.—The date of the annual meeting of this institute has been fixed for Wednesday and Thursday, May 4th and 5th, 1910. The meetings will be held in the rooms of the Institution of Civil Engineers, and the proceedings will begin by the induction of the new President, the Duke of Devonshire, into the presidential chair by the retiring President, Sir Hugh Bell, Bart. The annual dinner will be held on Thursday, May 5th.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Looking Back.—As usual at the close of the year the record of events and progress for the monthly period is eclipsed in interest by the tale of work accomplished during the whole year. Information as to the work of Clyde firms, as of other British centres and of firms in all parts of the world, will be found in the form of tabulated statistics on other pages, and in view of this the notes dealing with December need not be so detailed as usual and may refer to future prospects more than to work accomplished.

New Shipbuilding Orders.—Since our last month's notes were prepared definite confirmation has come of the order placed with Messrs. Caird & Co., Greenock, by the P. & O. Co., for two high-class mail twin-screw steamers, similar to the *Mantua*. Messrs. Wm. Denny & Brothers, Dumbarton, have secured an order from Messrs. P. Henderson and Co., Glasgow, to build a new steamer for their passenger and cargo service between Glasgow and Liverpool and Rangoon. She will have a deadweight carrying capacity of 8,500 tons. Messrs. A. Macmillan & Son, Dumbarton, have received an order for two steamers similar to the *Saruga*, built by them some time ago. Messrs. Barclay, Curle and Co., Ltd., Whiteinch, have received from the Blue Anchor Line the order for a large passenger and cargo steamer similar in type to other vessels which they have supplied to the same owners. Messrs. Alley & McLellan, shipbuilders, Polmadie, have booked orders for a stern-wheel steamer of 60 tons, and a steel barge of 80 tons, both for foreign owners. Messrs. Mackie & Thomson, Govan, have received orders for two trawlers of 110 tons each, one being for Belgian and the other for French ownership. The Clyde Shipbuilding and Engineering Co., Port Glasgow, have contracted to build a steamer for service on the Canadian lakes, similar to the vessel already supplied by the firm for this trade. The Ardrossan Dry Dock and Shipbuilding Co., Ltd., have received from Messrs. Paton & Hendry, Glasgow, an order for a single-screw steamer, the machinery for which will be supplied by Messrs. David Rowan & Co., The Canadian Pacific Railway Company, it was reported about the middle of December, had placed contracts for two large passenger steamers with a well-known firm on the upper reaches of the Clyde, but this lacks confirmation. The C.P.R. Board, about a month ago, decided to place orders for four large passenger boats, two of which are now said to have been secured by the firm referred to. Hopes are entertained that the other two contracts will also be placed on the Clyde.

Work of the Year.—Writing within measurable hail of the completion of 1909, but in advance of the latest statistics elsewhere to be found in these pages, it is possible to forecast with a fair degree of accuracy the measure of the year's industry as regards output of tonnage. The total output, as might have been expected from the information given in these notes from month to month, will be a considerable advance upon the output for the year previous, but still short of the figures for 1907, and even more so of those for 1906. The grand aggregate will very probably reach to within a nearness of 400,000 tons, and the number of vessels to about 230, or considerably fewer than for 1907, thus yielding a high average tonnage for individual vessels. As to the firms who have taken most notable share in the year's work, and the individual vessels of outstanding note, as regards size and character, these points are brought out in the statistical columns elsewhere. The year will certainly close with very considerably better prospects for both shipbuilding and marine engineering than there were at the close of 1908. The outstanding feature is certainly the large proportion of the naval to the mercantile work on hand and to begin. In fact, at no previous period has the Clyde ever had such a large proportion of naval work on hand, and if only one—if not two—of the much-talked-of "contingent" battleships and cruisers were to be placed on the Clyde the condition of affairs would be unprecedented.

Clyde Shipyard Extension.—The London & Glasgow Shipbuilding and Engineering Co., Ltd., Govan, were

commissioned by the Admiralty about the end of October to build one of the second-class cruisers of the improved "Bristol" type, of the same dimensions and tonnage, of course, as that ordered from Messrs. Beardmore & Co. Good progress has been made by the London & Glasgow Co., with the 27-knot torpedo destroyer, the order for which was received about the beginning of the year, but as very little else is at present on the stocks in this establishment, no time is being lost in proceeding with the preliminaries to actual construction. The turbine machinery for this cruiser, it should be stated, is to be supplied by Messrs. John Brown & Co., Clydebank. The London & Glasgow Co., for an extension to their working area, but especially in order to construct a new tidal basin in which their naval and other ships can be fitted out, have just acquired about 9½ acres of ground adjoining their shipyard, formerly occupied as a shipbuilding yard by Messrs. Robert Napier & Sons. The ground has been unoccupied since 1905, when Messrs. Beardmore & Co., who took Messrs. Napier & Co.'s business in 1900 removed their shipbuilding business to their new yard at Dalmuir. The ground was first used as a shipyard in 1841, and the first vessel built there was the *Vanguard*, an iron paddle steamer of about 700 tons, which was launched in June, 1843. Some thirty-four warships of different types have been built there, and in 1900 there were two armoured cruisers on the stocks, which were completed by Messrs. Beardmore after taking over the business. The new basin required by the London & Glasgow Co., will form a considerable addition to the dock equipment of the Clyde. In order to be better able to compete for the construction of turbine machinery and large reciprocating engines the London and Glasgow Co., whose works are the furthest up of any shipbuilding firm on the Clyde, have been converting the erecting shop at their engine works (on the opposite side of the Clyde) into a more modern machine and fitting shop and they have utilized some vacant area on the east side of the works for the erection of a new erecting shop. These several extensions and alterations are in a forward state of progress, and when completed will enable the company to carry out important contracts with more despatch and economy.

Ordnance Work on the Clyde.—The Coventry Ordnance Company's works, at Scotstoun, which have for several years been fully constructed, but have remained inoperative, owing to the lack of demand for ordnance, will be in active operation with the New Year. The manufacture of gun mountings is the special object for which the Scotstoun establisbment has been laid down, the guns themselves being constructed at the original premises of the firm at Coventry. Now that highly important contracts have been booked for mountings of heavy guns the Scotstoun works, in which the Fairfield Co., Messrs. John Brown & Co., Clydebank, and Messrs. Cammell, Laird & Co., Birkenhead, are directly interested, are now being set in complete order. It is understood that Admiral Bacon is resigning his naval command in order to take up the important appointment as principal of the new works. Such an appointment is not quite novel in this kind of technical industry. Rear-Admiral Adair occupies a similar position at Parkhead Steel Works, having control of the new gun factories there, which have already turned out one wire-wound gun and are engaged on the last stages of a second gun of the largest calibre.

Dundee as a Submarine Base.—The flotilla of submarines for the base at Dundee arrived in the Tay recently. The flotilla consisted of the repair ship *Vulcan*, the torpedo-destroyer *Wizard*, and eleven submarines. The *Vulcan* and the *Wizard* remained at anchor in the river. Nine submarines came into dock, the other two remaining alongside the *Vulcan*. A dry dock has been fenced in and made ready for the submarines. Seeing that the *Vulcan* had to lie outside for several hours till the flood tide enabled her to cross the bar the question of dredging the bar of the Tay to enable deep-draught vessels to enter at all states of the tide has been raised at the Dundee Harbour Board. It was explained that the *Vulcan* was drawing 27 feet, and there was 25 feet of water on the Tay bar at dead low water. With her draught she could not have got into Glasgow or Liverpool at dead low water. The cost of the dredging would be enormous, as dredging would have to be done from the bar to Dundee docks. The Board decided by a majority to take no steps in the matter at present.

Metal-Cutting by the Oxygen Process.—The cutting of steel—as well as its welding—by means of the oxygen process has made progress recently in the West of Scotland, and cutting and welding in the course of repair work to steam trawlers are being increasingly practised on the north-east coast of Scotland. Lately a large marine boiler was cut up by this process by Messrs. David York & Sons, Greenock, in the yard of Messrs. Russell & Co., Port Glasgow. By this process old boilers may be much more expeditiously reduced to scrap than by the older method of cutting them by hand. Metal-cutting by oxo-acetylene gas is carried out by the British Oxygen Co., Ltd., who have their head offices in London, and branches at Birmingham, Manchester, Newcastle, and at Polmadie, Glasgow. In the columns of this journal for October an illustrated account was given of the notable case of cutting off the entire stern of the large steamer *Tenasserim* in the course of repairs to her in one of the Glasgow docks. The process, which is simplicity itself, is based on the well-known fact that a jet of oxygen directed on a previously heated spot of metal ignites it, with the result that the metal acting as its own fuel, burns away rapidly in the form of iron oxide.

THE TEES AND HARTLEPOOLS.

(*From our Own Correspondent.*)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, are now very busy with the work on hand, some of which is for early delivery. They are also reported to have secured an order to build a large cargo steamer for delivery about next June.

Messrs. Smith's Dry Dock Co. have completed the removal of their shipbuiding business from North Shields and have now as many as twelve berths for the building of trawlers and other small steamers, of which they make a speciality. A good start has been made on six steamers of the ten they have in hand, besides repair work.

It is rumoured that there is every likelihood of the contract being placed locally by the British and India Steam Navigation Co., who are asking tenders for a large cargo and passenger steamer of about 470 feet long.

Messrs. Richardsons, Westgarth & Co., Ltd. are reported to have secured a contract to build the engines and boilers for a large cargo boat to be built locally. The Contraflo type of condenser will be fitted to this ship, of which such excellent results have been obtained that it is thought that only this type of condenser will be fitted in future. They also are fairly busy with some land contracts.

Messrs. W. Harkess & Co. are likely to secure an order to build a small steamer, with an early delivery.

Stockton and Thornaby.

Messrs. Craig Taylor & Co. are reported to have secured the order to build a cargo steamer for local owners, and are now fairly busy. The work in hand will take them well into next year.

Messrs. R. Ropner & Son are very busy with the work in hand, some of which is for early delivery. They also are reported to have secured an order to build a large cargo boat the machinery to be supplied locally.

Messrs. Blair & Co. are very busy with the work in hand. There is every reason to believe that they have secured fresh orders which will keep them busy all through the winter.

Locally at Darlington this last month some remarkably heavy cast-steel castings have been made by the Darlington Forge Co.; the cast-steel stern frame, rudder and brackets for the mammoth White Star liner *Titanic*, now being constructed by Messrs. Harland & Wolff, at Belfast will rank as the largest and heaviest which have been manufactured in connection with marine engineering the total weight amounting to over 280 tons and which have been transported to Hartlepool for shipment to Belfast by the s.s. *Glenmavel*. These castings were described and illustrated in our contemporary, the "Engineer," of Dec. 17th.

West Hartlepool.

Messrs. W. Gray & Co. have during the month secured the contract to build a large cargo steamer, the engines and boilers

for which will be made at their Central Marine Engine Works. They are fairly busy at both the old and new yards, and also have a fair amount of repair work on hand.

Messrs. Furness, Withy & Co. are reported to have purchased the fleet of seven steamers owned by the late Mr. James Mark Wood, of Liverpool, ranging in tonnage from 3,500 to 5,000 tons gross register, and of six to ten year old.

Messrs. Irvine's Shipbuilding & Dry Dock Co. have laid the keel for the Tyne and Tees passenger steamer, which is to be delivered by May. She is to be 290 feet long and is expected to do 14½ knots loaded to about 17-6. They have one steamer nearly ready for launching, and have been kept busy with the Harbour & Yard Dry Dock.

Hartlepool.

Messrs. Richardsons, Westgarth & Co. have secured the contract to fit engines and boilers to a large cargo steamer to be built by Messrs. J. L. Thompson & Sons, Sunderland. They are also busy with the work in hand, having about eight contracts, two of which will be fitted with Messrs. J. Howden & Co.'s system of forced draught. They are very busy with a contract for Thorne Colliery, which has to be working by February. They are also very busy in the Contraflo Condenser Department, working overtime on the work in hand.

An interesting ceremony took place in the drawing office of Messrs. Richardsons, Westgarth & Co., on Monday, Dec. 20th, when D. B. Morison, Esq., the Managing Director, presented prizes of money, books and drawing-instruments to the value of upwards of £200 to the successful apprentices in connection with the North-East Coast Apprentice Advancement Scheme.

Messrs. Irvine's Shipbuilding & Dry Dock Co. are fairly busy. Under the co.-partnery scheme they are to pay a 5% bonus to all employee shareholders over the guaranteed 4% dividend. They have a fair share of work, and it is expected the trial of this scheme will be extended a further three months.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

Humber Iron Works have had a very busy month. The R.M.S.P. *Pardo* has been in dry dock, general hull cleaning and painting, and s.s.'s *Spero*, *Algethi*, *Algol* and *Genet* have been on the slipways, renewing plates in bottoms, rudder pintails rebushing, etc. General hull cleaning and painting, deck and engine-room repairs have been plentiful. Numerous steamers have been in Victoria and Alexandra docks for general repairs, and the boilershop is busy with new and repair work.

Messrs. Woodall & Co., Engineers, Hull.—This is an old-established firm, with splendid tools, and in every detail well fitted to deal with marine repairs. They have now added to their staff an able and efficient sea-going engineer to manage out-door work.

Central Dry Dock and Engineering Co., Ltd., seem to be leading again in general docking and repair work. The Alexandra dry docks have been hired by them several times this month. The large Leyland liner *Ovonian* has been docked for general cleaning, scraping and painting of hull, besides renewing two new plates in starboard strake, also deck and engine-room repairs. They also docked the sailing ship *Dalgonar*, and the following steamers in the Central dry dock: s.s.'s *Pacific*, *Ethelbrytha*, *Pan*, for general hull painting and repairs, the s.s. *Adriatic* for number of plates in bottom, cleaning, painting and other repairs.

Messrs. Cooper & Co., Ltd., Engineers and Boilermakers, report keeping busy with general repair work and dry docking of steamers at their branch shop, Alexandra dock. Their main works in Neptune Street are fairly busy in the fitting and moulding shops. They are refitting four new furnaces in the Netherland steamer *Swan* and doing other repairs to her. Their Union and North Bridge dry docks are kept in constant work.

Messrs. Earle's Shipbuilding and Engineering Co., Ltd., are steadily going ahead under new management and seem fairly full up with orders for new Mediterranean and Continental steamers. They are also busy with repair work.

Messrs. Stewart & Craig, Engineers and Boilermakers, Hull, are coming ahead in general repairs and dry dock work. They have docked the following steamers: s.s. *Ella*, for general painting of hull and renewing two plates in bottom, and s.s. *Cedric*, new tail end shaft and propeller, hull cleaned and painted, in addition to deck and engine-room repairs to each. They also docked S.S.'s *T. S. Wermer*, *Sigrid*, for steering gear and deck and engine repairs. The s.s. *Persia* (ex-Anchor liner), bought by the Denaby Main Colliery Co. for a hulk for Portland, Dorset, has been overhauled and new derricks and steam winches fitted.

Messrs. C. D. Holmes & Co., Ltd.—This old-established firm is not so busy as formerly. They have just completed engines and boilers for the following trawlers for Grimsby owners *Martineta* and *Seruma*. Their branch at Alexandra dock estate has had several steamers under repairs.

Messrs. Amos & Smith, Engineers and Boilermakers, are keeping fairly busy with repair work of Wilson steamers, but no fresh orders are coming for new machinery or boilers.

The North-East Coast Engineering Works, have had the following steamers under repair this month: S.S.'s *Cornocupia*, *Armuwell*, *Paul Paix* and *Powerful*. The work is under the able management of Mr. E. Clarke.

THAMES.

(From our Own Correspondent.)

Warship Order.—The Thames Ironworks Co. is understood to have the refusal of an order for a battleship at the price of about £2,000,000, including guns and gun mountings and it is gratifying to be able to report this good news. We have alluded to the negotiations that have been in course for some time, and with the price fixed it is believed to be only the difficulty of fitting out down the river that is the final question at issue. What this means to the East End can be readily imagined when the 2,000 additional hands that will be required are taken into consideration. Guarantees have to be given to finish by March, 1912. We have stated the causes of the previous absence of shipbuilding orders on the Thames, and the firm is therefore greatly to be congratulated that it has, in face of the known difficulties, been able to submit a price that has been successful in competition. The vessel to be built will be about 700 ft. long and with a displacement of 22,500 tons is to have a speed of 21 knots. The wages therefore distributed for the two years will amount to about £3,000 a week, and this will be a boon to this part of London which will be heartily appreciated.

Shipping Co.'s.—The P. & O. Co. had a very favourable report at their annual meeting. The usual dividend and bonus is paid and there is a carry forward of £65,488. Mention was made by the Chairman of the service to New Zealand recently inaugurated and also of the line established between Shanghai and Yokohama, which should prove a support to the Company. As to the Orient Co., which also held its meeting, the new ships have answered every expectation and the company pays 5% dividend on the deferred shares after the preference and leaves a balance of £27,286 to carry forward. The Union Castle Line are extending their itinerary up the East African coast and the first vessel to sail in connection therewith is the *Dunluce Castle* leaving with the beginning of the year, the service being every twenty-eight days thereafter. Hitherto we have had to depend on German vessels in this part of the world, so the new departure will cause some amount of attention and will be welcome to British travellers.

The New Thames Bridges.—More details are to hand of the great improvements foreshadowed by the new undertakings the city is to take in hand. During the reconstruction of Southwark Bridge traffic will be entirely stopped for vehicles and a temporary structure erected for foot passengers. The new bridge will be wider than the old one and the gradients improved. Steelwork will be substituted for the present cast-iron arches and the piers may have to be rebuilt as well. As regards St. Paul's Bridge this will be placed midway between Southwark and Blackfriars bridges, and form a complete new artery from north to south. The middle of the new bridge is to be 80 feet between parapets

and with two 15 feet pavements there will be 50 feet of roadway. It is estimated that these two projects will cost £1,907,000.

New Thames Wharf.—Great interest is being evinced in the approval given by the Dartford Commissioners of Sewers for a scheme of deep-water wharves at Long Reach, near Dartford, which has in view the relief of traffic higher up the river. The new wharf is said to be planned for 3,600 feet long and 50 feet wide, and this important work is likely to be started at an early date.

The South Pole Expedition.—With the beginning of the year work will commence in earnest on the *Terra Nova*, the vessel acquired for this service. The removal of oil tanks and minor work has been already taken in hand and now the structural alterations will begin. Most of the scientific staff has already been engaged, and the special equipment required in the way of draught animals and apparatus is already well in hand. No time is therefore being lost to ensure every chance of success to the forthcoming expedition.

Thames Pier Charges.—In March last the London County Council sanctioned bye-laws under the Thames River Steamboat Service Amendment Act, 1908, relating to rates to be charged at the Council's piers, and the Board of Trade, who were asked to confirm these rates, and after due representations by those interested, state that the maximum rate of 6d. proposed to be charged in respect of any person embarking upon or landing from a vessel should be reduced to 4d. To this the committee of the Council have agreed.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works.—H.M.S. *Savage*. The boilers are shipped and erected and the turbines are being fitted on board. The vessel will be launched this month.

H.M.S.'s *Larne, Lyra, Martin and Minstrel*. The bending of these vessels' frames is now nearly completed and two of the vessels were in frame last month.

Shallow draught tug boat for Russia. This vessel's plating was completed last month, and it is expected that she will be ready for steaming early this month.

Mine laying and torpedo base vessel for Portugal. This vessel is now ready for launching, and the machinery was placed on board at the latter end of last month.

Four ferry steamers for Calcutta. The material for these vessels was despatched last month to Calcutta.

Two of the four motor launches on order are completed and were despatched last month.

Repair Work. The Royal Fleet auxiliary vessel *Mercedes* is now being repaired by the firm, and extensive alterations are being carried out. This is one of the largest repair jobs that has come to the port for many years past, and the alterations and repairs will occupy about three months. Repair work was also carried out last month on H.M.S.'s *Plucky, Princess Ena* and the transports *Plassy* and *Rohilla*.

Messrs. J. S. White & Co., Ltd., East Cowes, Isle of Wight. *Manatee*. This vessel, a description of which we gave in our last month's notes, has sailed under her own motor power for West Africa, and was reported from Corunna, all well. H.M.S. *Harpy*, ocean-going destroyer, was launched November 27th. An equipment of steam boats comprising two 56 feet vedette boats, one 36 feet launch and one 32 feet cutter for the Brazilian battleship *Minas Geraes*, have been delivered to the battleship at Elswick shipyard. These vedette boats obtained a speed of 17 knots on the three hours' trial. A steam cutter for the Brazilian scout *Bahia* has also been delivered.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Vickers' Company.—One is considerably in the dark as to what the amount of work Vickers & Co. have booked. There are rumours without end and some of them are somewhat startling, but at the moment all matters relating to work for this huge yard are kept very secret. The two floating docks have passed Barrow, as was to be expected, one having gone, it is said, to Messrs. Cammell, Laird & Co., of Birkenhead, and the other to Messrs. Swan, Hunter & Co., on the Tyne. Of the contingent "Dreadnoughts," and who is to build them, nothing is known. In previous notes in this column I have suggested that an order for a "Dreadnought" was likely—sure, in fact—to come to Barrow, but from what I can gather there seems to be a doubt about it, and it would not be surprising to learn that the order was for a battleship cruiser and turbine machinery. Messrs. Vickers & Co. have already booked an order for the 70,000 horse-power machinery of the battleship-cruiser *Lion*, which is being built at Devonport, and it seems very natural that they should be able to book an order for the sister ship. These battleship-cruisers are to be some 700 ft. long, 86 ft. or so wide, and it is almost a certainty that they will mount ten 12-inch guns with such a length. At the time of writing everybody in Barrow is on the *qui vive* for information, which in view of the coming election should not be long before it is public—for obvious reasons. As to the orders for a "Dreadnought" for New Zealand and a battleship-cruiser for Australia, nothing known. It may, of course, mean that six vessels will be ordered altogether. The general opinion here is that even should six orders be given out no firm will get more than one to build.

[Since the receipt of our correspondent's notes the official statement that Vickers have received an order for a battleship-cruiser has been made.—ED. *M.E.*]

Then there are rumours of foreign orders. There is nothing of the Argentine work yet, but Chili is mentioned, so are China-Japan, and lastly Russia. The Chinese Commission paid a visit during December to Messrs. Vickers' yard, and inspected their huge works, and also took train to the gun-testing ground at Exmeals. It was very bad weather during the whole of their stay, but it did not interfere with a great fireworks display at Furness Abbey, in their honour.

There is nothing known as yet as to where the order for the 23-knot Cunarder is going. Such an order would be a boon to Barrow, as it would mean so much labour for every branch of workers in the yard, but the competition for this class of work is very keen and the margin of profit is very little indeed. Still it would be fortunate if the firm could get their hand into this class of work.

H.M.S. "Vanguard's" Trials.—The battleship *Vanguard* is now lying at the Buccleuch fitting-out wharf alongside the Brazilian *Sao Paulo*. The new practice of using the exhaust steam from the multitudinous auxiliary machinery in the low-pressure turbine was found to be a success, but there are many who hold that such practice is only obtainable when the ship is steaming at low power. The trials were conducted under these conditions, so it may be taken for granted that the Admiralty are of the same opinion. Working at full power the auxiliary machinery would be severely hampered with having to exhaust into the turbine. It would reduce the efficiency. As to her trials they have been everything that could be desired. Messrs. Vickers' have established a world's record with this vessel, for they have built her and got her through all her trials in a little over nineteen months. Her keel was laid on April 2nd, last year. The *St. Vincent* was begun three months before this and the *Collingwood*, another sister ship, was begun in February, 1908, and yet the *Vanguard* is out the first easily, which if anything, proves the superiority of a private yard over a dockyard. On her eight hours full-power trial 24,500 I.H.P. was easily obtained, and over the Polperro course the *Vanguard* attained a fraction under 22 knots, or about a mile above contract speed. The coal consumption was only 1·6 lb. per shaft horse power per hour on this trial. The gun trials were satisfactory and the auxiliary machinery also passed inspection. It is expected that shortly after the New Year the *Vanguard* will be ready for delivery.

Extensions. Despite the fact that Messrs. Vickers have taken in a deal of land recently one hears talk of the firm being still pinched for room. The recent orders have resulted in great alterations on the engineering side in order that they can better cope with the volume of work and all the land is spoken for. On the ship side the land which extends to the Walney bridge is all taken up with sheds and some novel testing machinery. The offices are having two more stories built on them, and this will mean a great improvement in the appearance. All these extensions and alterations do not carry the firm far into the future and in view of further developments, which it would not be wise to discuss at the moment, one can only see them having to cross the road and

make incursions on the land in Cavendish Park. The docks and the channel stop them on the other side. Walney Island would be splendid if there was railway communication over the channel.

Furness Railway Co.—The Furness Railway Co. are still in negotiation for a new, or nearly new, steamer for their Fleetwood service. It was at one time thought that they would have one built, but the Barry Railway Co. have offered to sell the *Barry*, which is a practically new steamer, having been built in 1907. It is to be hoped that the local company will be successful in securing her, for a good vessel on that service is badly needed. The vagaries of the *Philomel*, an old General Steam Navigation boat, did not do this now popular route any good.

Floating Docks.—Work is proceeding apace with the construction of the Brazilian and Aberdeen floating docks, and plates are regularly arriving from Cardiff. The Brazilian dock, which is for "Dreadnoughts," has to be delivered twelve months from time of order at Rio Janeiro, so there is no time to waste, but a firm that can complete a "Dreadnought" and get her through her trials in nineteen months should have no difficulty about a floating dock. As to the method which is to be adopted in regard to taking this dock out nothing is made public yet, but the sum of £16,000 is set aside for that purpose, and, of course, that sum will include insurance.

Brazilian "Dreadnought."—Work on the *Sao Paulo* is proceeding without a hitch, but there is not the same hurry required about this vessel as the *Vanguard*. The tripod is now in position and the two funnels are in, and it will not be long before the builders are getting a turn out of the engines. By the way, the talk of the third Brazilian battleship seems to be all talk as usual. Nothing is known of the order as yet. Messrs. Vickers' staff at the moment are over on the East coast, where one of the Brazilian scouts is undergoing trials. These trials had to be postponed owing to inclement weather.

Hæmatites.—The hæmatite iron trade remains about the same, and prices remain firm. American advices keep the market in a careful mood, and several orders are reported. Makers are asking 63/6 per ton nett, while warrant iron is quoted at 62/- per ton one month sellers, while three months is 63/7½.

Shipping.—Shipping is not very brisk and the freights are not great; there have been large importations of oil. The total exports of iron and steel for the year amount to close upon 600,000 tons, which is an increase of 111,000 tons, as compared with the aggregate for the corresponding period of last year.

BELFAST.

(From our Own Correspondent.)

Past and Future.—During the past twelve months Belfast has suffered along with other centres from the depression in the shipbuilding trade. But the slackness has not been so marked here as elsewhere, and a number of notable vessels have been launched. Amongst other firms for whom local builders have constructed steamers during the year may be mentioned the Leyland line, Bibby line, Orient line, Royal Mail Steam Packet Company and Messrs. M'Ilwraith, M'Eacharn & Co., while a whole fleet of steamers has been built for the Lloyd Brazileiro Co., and for the Tropical Fruit Steamship Co. The prospects for 1910 are good, for there is at present a fair amount of work in hand, and a considerable volume of fresh tonnage has recently been contracted for.

Messrs. Harland & Wolff.—Good progress is being made with the construction of the *Titanic*, the second of the two White Star leviathans building at the Queen's Island. The huge stern frame and propeller brackets have been transported from Darlington to Hartlepool, whence they will be shipped to Belfast by the Antrim Iron Ore Co.'s steamer. As in the case of the *Olympic's* frame, the carriage by rail was accomplished on a Sunday, the operation occupying the greater part of the day, and three sets of rails requiring to be cleared on account of the tremendous outreach of the big casting. To take the strain of this overhang a twenty-five ton travelling crane had to be sent along with the wagons. The framing of the sister ship *Olympic* has been completed, in addition to which a considerable amount of plating has been done, and most of the decks laid. The Royal Mail Steam Packet Company's *Balantia* is receiving the finishing touches preparatory to departing on her trial trip, which will take place before these notes are in print. Extensive overhaul and alterations are being carried out on the Holland-Amerika liner, *Nieuw Amsterdam*, to which reference was made in last month's issue. In addition to other inside work the passenger accommodation is being considerably increased. Amongst other vessels recently contracted for by Messrs. Harland & Wolff are a P. & O. liner and a vessel of big dimensions for the well-known Aberdeen line.

Messrs. Workman, Clark & Co.—On 16th December, this firm launched a fine new steamer named *Rangatira* for the Shaw, Savill & Albion Co., and a week or so previous they put in the water the new Harrison liner *Professor*. They have still another vessel to send from the stocks ere their year's output of tonnage is complete. During the month they have completed and sent to sea another Lloyd Brazileiro vessel, the *Bocaina*, whose launch was referred to in the December issue. Within the past month or so orders have been placed with Messrs. Workman, Clark & Co., for a new Tyser liner and two large steamers for the Holt line. They are at present engaged on extensive repairs to Messrs. Glen's s.s. *Kilmorack*.

Turkey's Navy.—A syndicate largely composed of Belfast business men has purchased the entire Turkish Navy. This is not to be taken as a big step in the direction of the dismemberment of the Empire. The fleet is not to be used by Ireland against England, but is to be broken up and converted into scrap, and then, if all goes well, into cash. The iron and steel is to be sold in Italy, while the copper and brass will be brought to the London market. The operations in connection with the breaking up will extend over two or three years.

Silley's Patent Smoke-Box Door.—A few years ago marine engineers, though not satisfied with, certainly had to be content with the old-fashioned smoke-box door, which was usually secured to the casing by means of a number of clips with outside handles. The old style of door was a source of constant trouble, being always difficult to shut properly, the operation generally involving the labour of two or three men armed with rakes or brooms, the top clips having an awkward knack of getting between the door and the casing instead of slipping into its proper position. When shut, or we may say, when supposed to be shut, the joint was only fairly good at the points where these clips were fitted, but between them the door invariably buckled. This, of course, meant a leakage of cold air into the smoke-box, causing cooling of the tube plate and the gases, a consequent loss of boiler efficiency and draught, involving also a repair bill at the end of the voyage for fairing up the doors. The fact that during the last four years some 8,000 doors, made according to the Silley patent, have been fitted, and this during a period when shipbuilding has been far from brisk, and when shipowners' earnings have compelled them to build as cheaply as possible, avoiding all extras, is sufficient proof that superintendent engineers have not only recognised the disadvantages of the old door, but have also appreciated the advantages of the Silley door. By the adoption of this patent a continuous metal joint is secured all round, by means of angle irons, which on being turned over on hinges, and having wedge pieces fitted, slide and tighten into corresponding wedge-shaped brackets fastened to the casing; and it should be specially noted that all the fittings are made of steel stampings of the best material. Under these conditions it is practically impossible for the doors to buckle, even under the severest conditions. They are also specially insulated and it is to be noted that owing to the fact that the angle irons are not riveted to the doors the latter are free to expand and contract without altering their shape in any way. We consider it sufficient evidence that Silley's doors are "the doors" from the fact that Messrs. James Howden & Co. are now recommending them for every installation of their patent forced draught system. It is also worthy of note that the British and United States Navies have adopted them, and it must be very gratifying to the Air-Tight Smoke-Box Door Syndicate, Ltd., of 155, Fenchurch Street, London, that the two new White Star leviathans now building at Belfast and the new Cunarder building on the Tyne are to be fitted throughout with the patent doors.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Rustington.—On November 24th, Messrs. Richardson, Duck & Co., launched from their yard a steel screw steamer of the following dimensions:—Length overall, 352 ft.; breadth extreme, 49 ft.; depth moulded, 23 ft. 2 in.; gross tonnage about 3,030 tons. This vessel, which has been built to the order of the Southdown Steamship Co., Ltd., of London (Messrs. Bell, Symondson & Co., Managers), will class 100A1 in Lloyd's Register, and has been built under special survey and under the superintendence of Mr. R. T. Rutherford, on behalf of the owners. She is of the single-deck type with clear holds, both beams and quarter pillars being dispensed with. She has a cargo poop, long bridge extending from before foremast to abaft mainmast, and a topgallant forecastle, and has been designed to carry a D.W. of 5,450 tons on about 20 ft. 8 in. mean. A cellular double bottom all fore and aft, and forward and after-peak tanks are fitted for water ballast, and equipment includes six steam winches, large horizontal multitubular donkey boiler, eleven derricks, steam windlass with quick-warping ends, stockless anchors, steam-steering gear, etc., etc. The engines, by Messrs. Blair & Co., Ltd., have cylinders 23½ in., 39 in., 64 in. by 45 in. stroke, steam being supplied by two single-ended boilers having a working pressure of 170 lbs.

Zurichmoor.—On November 25th, there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, a steel screw steamer, built to the order of Messrs. Walter Runciman & Co., Newcastle-on-Tyne. The vessel is of the improved single-deck type, and is built to Lloyd's highest class, and under their special survey. She is 358 ft. 6 in. in length by 49 ft. by 26 ft. 8½ in., with poop, long extended bridge and topgallant forecastle. The vessel is fitted throughout with shifting boards and feeders, in compliance with the requirements of the Grain Loading Act, and is well equipped with a large number of steam winches and derricks for the rapid handling of cargoes. She has a double bottom for water ballast, as well as a large after-peak tank. The vessel will be fitted with triple-expansion engines, also constructed by Messrs. John Readhead and Sons, Ltd., having cylinders 25 in., 42 in. and 68 in. by 45 in. stroke, steam being obtained from two large steel boilers of 160 lbs. working pressure. There is also a large marine type donkey boiler. This is the eighteenth vessel built for the above firm by Messrs. John Readhead & Sons, Ltd.

Hargrove.—On November 25th, Messrs. William Gray and Co. Ltd., launched the steel screw steamer *Hargrove*, which they have built for Messrs. Harrison, Tidswell & Co., London, for their Hamburg coal trade. She will take the highest class in Lloyd's and is of the following dimensions:—Length overall, 275 ft. 6 in.; breadth, 36 ft.; and depth, 19 ft. 6 in. She is a handsomely modelled vessel of the single-deck type with poop, bridge and topgallant forecastle. The hull is built with deep bulb-angle frames, clear holds, cellular double bottom and large fore and after-peak ballast tanks, she has four extra large hatchways for loading and self-trimming all parts of the holds. There are eight powerful steam winches placed on raised platforms, and in addition to the usual derricks there are twelve gaffs fitted for rapidly discharging coal, the masts being extra strong to carry all the required gear; special arrangements are also provided for discharging by shore grabs. Steam-steering gear is fitted amidships and hand-screw gear aft, direct steam windlass, stockless anchors, telescopic masts with fore and aft rig, and a first-class outfit for the vessel's special trade. The machinery is made by the Central Marine Engine Works of the builders, being of the triple-expansion type with cylinders 21 in., 33 in. and 56 in. dia. with a piston stroke of 36 in., and is fitted with two large steel multitubular boilers to work at a pressure of 180 lbs. per square inch. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel has been applied to the holds, bunkers and engine and boiler-room tanks, and their "Bitumastic" covering to the tank top in boiler space.

Pikepool.—On November 26th Messrs. Ropner & Sons, Ltd., Stockton-on-Tees, launched from their shipbuilding yard a steel screw steamer of the following dimensions, *viz.*:—Length, 358 ft. 6 in.; breadth, 50 ft. 10 in.; depth, 25 ft. 6 in. The vessel is built to the highest class in the British Corporation Registry, having main deck, poop, bridge and topgallant forecastle. The vessel has double bottom for water ballast on the cellular principle, and in the fore and after peaks. She will be fully equipped with an up-to-date outfit, including quick-warping steam windlass, stockless anchors, steam-steering gear amidships and powerful screw gear aft. The appliances for loading and discharging cargoes expeditiously are very complete, and include nine steam winches, double derricks to each hatch, steam being supplied by a large donkey boiler working at 100 lbs. pressure per square inch. The engines will be of the triple-expansion type by Messrs. Blair & Co., Ltd., Stockton-on-Tees, of about 1,500 I.H.P., having two steel boilers 16 ft. by 10 ft. 6 in., 180 lbs. steam pressure.

Rachel.—On November 26th, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Rachel*, which they have built for T. W. Stephens, Esq., of London. She will take the highest class in Lloyd's and is of the following dimensions:—Length overall, 373 ft. 6 in.; breadth, 51 ft.; and depth, 24 ft.; with extra long bridge, poop, and topgallant forecastle. The hull is built with deep bulb-angle frames, cellular double bottom and large after-peak ballast tanks, eight steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 40½ in. and 67 in. dia., with a piston stroke of 45 in. and three large steel boilers for a working pressure of 180 lbs. per square inch. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the lower and bridge bunkers.

Benwood.—On November 27th, Messrs. Craig, Taylor and Co., Limited, launched from their Thornaby Shipbuilding Yard, Stockton-on-Tees, a finely modelled steel screw steamer to carry about 6,800 tons deadweight on a light draught of water. The owners, Messrs. Joseph Hoult & Co., Ltd., of Liverpool, were represented at the launch by Mr. B. Allen, of Liverpool, under whose superintendence the vessel has been built. Messrs. Craig, Taylor & Co., Ltd., some years ago built four steamers for the same owners.

Varanis. On November 30th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 123 ft. 4 in. by 21 ft. 6 in. by 13 ft. 10 in. moulded. The vessel has been built to the order of Messrs. The Arctic Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. Amos & Smith, Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Livorno. On December 1st, Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull, launched from their yard a handsomely modelled steamer, built to the order of Messrs. T. Wilson, Sons & Co., Ltd., for the Hull, Sicily and Adriatic trade. The principal dimensions are Length, 300 feet; breadth, 42 feet 6 ins.; depth, 20 feet moulded. She has been constructed of steel to the British Corporation Registry's highest class B.S. and to the Board of Trade latest requirements. The vessel is of shelter-deck type and will have a large deadweight and measurement capacity. She will be fitted with two pole masts to suit the Manchester Ship Canal regulations, all necessary derricks and cargo gear, six steam winches, steam windlass, steam and hand-steering gear.

Dumb Hopper Barge. On December 7th the Blyth Shipbuilding & Dry Docks Company Limited, launched from their Shipbuilding and Graving Dock Works a 600-ton steel Dumb Hopper Barge built to the order of the North-Eastern Railway Co., which has been specially constructed in connection with their various dock and harbours. Powerful machinery will be supplied by Messrs. Langyes, Ltd., of Birmingham, and Messrs. Lobnitz & Co., Ltd. of Renfrew, for raising and lowering hopper doors. This barge is the fourth of five which the Blyth Shipbuilding and Dry Docks Company, Limited, are constructing at

present for the Railway Co., and has been built to the specification of T. M. Newell, Esq., Chief Dock Engineer to the N.E.R. and under the general supervision of G. Shaw, Esq.

Boverton.—On December 7th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, a steel screw steamer for Messrs. Evan Thomas Radcliffe & Co., of Cardiff, and of the following dimensions, *viz.*: Length, about 341 ft.; breadth, 48 ft.; depth, moulded, 24 ft. 4½ in.; and to Class 100 A1 at Lloyd's on the single-deck rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including six double-cylindered steam winches, direct-acting steam windlass, large multitubular donkey boiler, steam-steering gear by Messrs. Lynn and Co., and screw gear aft. The engines, which are supplied by Messrs. North-Eastern Marine Engineering Co., Ltd., of Wallsend, are of the triple-expansion type, having cylinders 24, 40 and 65 by 42 in. stroke, and working at a pressure of 180 lbs.

Rochester City.—On December 9th, Sir Raylton Dixon and Co., Limited, launched from their Cleveland Dockyards, Middlesbrough, a fine steel screw steamer built on the Cantilever Frame System with topside water-ballast tanks, to the order of Mr. W. A. Watson, of Sunderland, to fulfil the very special requirements of her owner's coal-carrying trade between the north-east coast ports and the Thames. The vessel is being constructed to receive Lloyd's 100 A1 class under special survey, her leading dimensions being 240 ft. by 35 ft. 3 in. by 17 ft. 6 in. moulded, and she will have a deadweight carrying capacity of about 1,900 tons on a light draught of water. Water-ballast capacity is 760 tons, of which 330 tons is carried in the topside tanks under the deck. She has five holds, which are perfectly self-trimming and absolutely free from all obstructions such as beams, pillars, or web frames, and four large hatchways, the largest of which is 35 ft. 5 in. long by 22 ft. wide. The vessel will also have two donkey boilers, four powerful steam cranes, winch, windlass, hand and steam-steering gear and all the latest and most modern appliances for the rapid handling of cargo. Triple-expansion engines, placed aft, having cylinders 17½ in., 29 in. and 47 in. by 33 in. stroke, supplied with steam by a large single-ended boiler working at 180 lbs. pressure, will be fitted by the North-Eastern Marine Engineering Co., Limited, Sunderland.

Devereux.—On December 11th, Messrs. S. P. Austin and Son, Limited, launched from their shipbuilding and repairing establishment at the Wear Dock Yard, Sunderland, the steel screw steamer *Devereux*, which has been built to the order of Messrs. Wm. Cory & Son, Limited, of London, and is the nineteenth vessel constructed by them for the same owners. The vessel has a long raised quarter-deck, bridge, and forecastle, and accommodation will be provided for the officers at the fore end and the engineers at the after end of the bridge, with a saloon house on the bridge for the Captain. The deadweight capacity is about 2,020 tons on a light draught of water, and there are large hatchways specially adapted for the owners' coal trade, fitted with every appliance for quick loading and discharging. The vessel will be classed 100 A1 in Lloyd's Register under special survey, and will have large water-ballast capacity. Special attention has been given to the speed of the vessel, and she will be able to make fast passages with machinery supplied by Messrs. George Clark, Limited, Southwick Engine Works, Sunderland. The auxiliary machinery is by first-class makers. Messrs. Wailes, Dove & Co.'s bitumastic covering has been applied to tank top in boiler room, and their enamel to the bunkers.

Prince Rupert.—On December 13th, at the Wallsend Shipyard of Messrs. Swan, Hunter & Wigham Richardson, Ltd., the launch of the passenger steamer *Prince Rupert* took place. The *Prince Rupert* is being built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., at Wallsend-on-Tyne, to the order of the Grand Trunk Pacific Railway Co., of Canada. Mr. R. L. Newman is superintending the building of both this vessel and another similar one in the same shipyard. These steamers will inaugurate a new and most important service between Prince Rupert, which is the western terminus of the Grand Trunk Pacific Railway, and Vancouver, and thence to Victoria at the southern end of Vancouver Island, and onwards to Seattle or Tacoma. This route, some 750 miles long, lies entirely among the islands of the coast of British Columbia. The steamship *Prince Rupert* will have a straight stem and cruiser stern, two pole masts and three funnels, the centre one bearing the flag device of the Company. The rounded cruiser stern has been adopted in order to obtain the best lines to give a high speed. On service the ship will run at 17 to 18 knots an hour, though about 19 knots may be run on trial. Her dimensions are 320 ft. overall in length; 42 ft. 2 in. in breadth; with a depth of 18 ft. to the main deck. The ship is being built to the highest class under the British Corporation survey and will also comply with the Board of Trade regulations for passenger steamers. The gross tonnage of the vessel is 2,850. The engines and boilers with Howden's forced draught are being constructed by the Wallsend Slipway & Engineering Co., Ltd. The former consist of two sets of triple-expansion engines, balanced on the Yarrow, Schlick & Tweedy system. This system of balancing engines without weights was elaborated a good many years ago, chiefly by the firm of Wigham Richardson & Co., who held and improved the patents, which were taken up by practically every marine engine builder of note. On the shelter and shade decks there is accommodation in state-rooms of two berths each for about 220 first-class passengers. There will also be a few sets of state-rooms *en suite* placed on the shelter deck amidships. Second-class passengers will be carried on the main deck forward. When occasion arises, about 1,500 excursionists can be taken on board. In the first-class accommodation will be two spacious corridors running fore and aft, one on each side of the engine casing, and light will be given from several domes in a long roof. The dining saloon on the main deck is placed at the extreme after end of the vessel. The rounded shape of the cruiser stern makes an extremely handsome room, furnished and panelled in oak. Immediately forward of the dining saloon are the stewards' pantries and the kitchens. At the after end of the shade deck will be a handsome smoke-room for first-class passengers, and the second-class smoke-room is placed at the forward end of the shelter deck. A music room for ladies will be provided. The main staircase of the ship will be a notable feature, the panelling of the walls being in white enamel and the balustrades of wrought iron elegantly designed. The promenade on the shade and boat decks will be spacious, and on the shade deck forward of the funnels is the observation room. This room will be specially lofty and well lighted by very large square windows, to afford an uninterrupted view of the scenery *en route*. The *Prince Rupert* will be provided with a wireless telegraphy installation, refrigerating machinery for ship's stores and dairy produce, electric light and steam heating throughout. The rudder is of the balanced type, wholly below the waterline, and will be actuated by a telemotor steering gear.

Himalaia.—On December 13th, the Northumberland Shipbuilding Co., Ltd., launched from their yard at Howdon-on-Tyne, a finely-moulded steamer built to the order of D. Tripcovich, Esq., of Trieste, Austria, the vessel being named *Himalaia*, and the fifth built for this owner. The steamer is 402 ft. long by 52 ft. 6 in. beam by 29 ft. 8 in. deep, and has been built under special survey to the highest class at Lloyd's. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation, which is very ample, being all placed in steel houses on the bridge deck. The 'tween decks are lofty and so arranged that cattle, troops or emigrants may be carried if necessary. The loading and discharging facilities are most complete, the steamer having thirteen steam winches, a large number of cargo derricks and steam windlass and capstan, and a complete installation of electric light. She is fitted with the usual water ballast arrangements for light passages. She has been constructed to a fine model with a view to rapid speed and economy in fuel, and the machinery will be supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend, consisting of engines with cylinders 26 in., 42 in., 72 in. by 48 in. stroke, three large boilers 15 ft. by 11 ft., 180 lbs. working pressure. The steamer will carry about 8,000 tons d.w. on 24 ft. draught, and steam about 11 knots speed loaded at sea. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel has been applied to the boiler-room tank bilges and 'tween deck bunkers, and their covering to tank top in boiler-room.

Edilio.—On December 14th, Messrs. W. Doxford & Sons, Ltd., launched from their yard at Pallion the s.s. *Edilio*, built to the order of the Societa Commerciale Italiana de Navigazione, of Genoa. The dimensions of the vessel are:—Length, 378 ft.; breadth, 51 ft. 6 in.; moulded depth, 30 ft. 3 in.; and the deadweight carried is about 8,000 tons. Messrs. Doxford are also supplying the engines and boilers. The vessel is classed with the British Corporation. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel has been applied to the boiler-room tank and their "Bitumastic" covering to tank top in boiler-room.

Karuma.—On December 14th, Messrs. Robert Thompson and Sons, Ltd., successfully launched from their Southwick yard a first-class cargo steamer, built to the order of Messrs. The Unison Steam Shipping Co., Ltd., of London, and the third vessel they have built for the same management. Her principal dimensions are:—Length B.P., 321 ft.; breadth extreme, 48 ft.; and depth moulded, 23 ft. 10 in. She has been built to take the highest class at Lloyd's, under special survey, and is constructed on the single-deck principle with bulb-angle framing, leaving the holds clear of all obstructions. Poop and bridge will also be available for cargo. Ample water ballast is provided in the cellular double bottom and after peak. The tank top under boilers, also bunkers, are coated with patent enamel. Five cargo hatches are fitted complete with all appliances for rapid loading and discharging, worked by powerful steam winches, and large multitubular donkey boiler of ample capacity for the supply of steam to the deck machinery. The engines of the triple-expansion type are by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, having cylinders 23½ in., 39 in. and 64 in., with a stroke of 42 in., steam being supplied by two extra large boilers working at 180 lbs. pressure.

LAUNCHES—Scotch.

Hurst.—The steel screw steamer *Hurst* has been launched at Greenock. The vessel, which has been built to the order of the Clyde Shipping Co., for service in the East, is of 7,700 tons carrying capacity.

Valdura.—On December 11th, there was launched at Port Glasgow the steel screw steamer *Valdura*, of 4,000 tons gross, which has been built for the general carrying trade of Messrs. Gow, Harrison & Co., Glasgow. The vessel, which has been constructed to Lloyd's highest class, is of the following dimensions:—Length, 415 ft.; breadth, 56 ft.; depth, 30 ft. 6 in. The engines, with cylinders 27 in., 45 in. and 74 in. in diameter by 51 in. stroke will be supplied from Greenock. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering has been applied to the tank top in boiler-room and donkey boiler recess and their enamel to boiler-room tank, deep tank and bunkers.

San Francisco Xavier.—The Greenock & Grangemouth Dockyard Co., Ltd., have launched from their Greenock yard the steel screw passenger steamer *San Francisco Xavier*, built for the service in East Indian waters. The dimensions of the vessel are:—Length, 170 ft.; breadth, 26 ft.; depth, 9 ft. 6 in. to main deck and 16 ft. to awning deck.

Francis.—On December 12th, Messrs. Barclay, Curle and Co., Whiteinch, launched the single-screw cargo and passenger steamer *Francis*, the first of two which they are building for the Booth Steamship Co. Ltd., Liverpool, for their South American trade. The second vessel will be launched early in the beginning of the New Year. The principal dimensions of the *Francis*, which is built to Lloyd's highest class, are:—Length, 367 ft.; breadth, 49 ft. 3 in.; and depth, 26 ft. 6 in. to the upper deck. The gross tonnage is about 4,000. The vessel is fitted with ten derricks and in addition one heavy derrick capable of lifting a weight of 45 tons. The engines are of the triple-expansion type, and the required speed is 11 knots at sea fully loaded. Messrs. Matthew Keenan and Co. have covered the boilers and all steam pipes with their composition. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel has been applied to the bunkers and their "Bitumastic" covering to the tank top in boiler room.

Kirkdale.—On November 25th the spar decked steel screw steamer *Kirkdale* was launched at Port Glasgow. The vessel, which has been built to the order of Messrs. James R. Cuthberston & Co., Glasgow, is designed to carry 7,800 tons. She is 400 ft. in length, 52 ft. in breadth and 29½ ft. in depth. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering has been applied to the tank in boiler-room and their enamel to boiler-room tank and deep tank.

Sir Trevredyn Wynne.—On November 29th, there was launched at Dumbarton the train ferry steamer *Sir Trevredyn Wynne*, which has been built for the service on the Hoogli of the Bengal-Nagpur Railway Company. The principal dimensions of the vessel are:—Length 300 ft.; breadth moulded, 50 ft.; depth at side, 11 ft. 9 in. She is built throughout of mild steel and is of great strength, as she is required to carry three heavily loaded goods trains on her deck. As the loading may be somewhat unequal, care has been taken to guard against racking, as well as against longitudinal strains. At each end there is a set of three turntables, worked by steam and controlled from the deck-house, the vessel is not intended to cant in the river she is similar at both ends, being of a modified spoon shape and all gear is duplicated so that she may run either ahead or astern. Water ballast tanks are fitted at the ends for trimming purposes. The propelling machinery consists of two independent sets of paddle engines, which together with the boilers have been designed to come entirely underneath the main deck. The four funnels are of elliptic section, so as to offer the minimum of obstruction to the passage way between the trains. All the woodwork is of teak, so as to resist the climate and the attacks of white ants.

Strathdene.—On November 29th, there was launched at Greenock the screw cargo steamer Strathdene, which has been built for Messrs. Burrell & Son, Glasgow. The vessel has a deadweight of 7,150 tons on a draught of 23 ft. The capacity of the double bottom and deep tank is 1,900 tons of water ballast. The vessel has been built under the special survey of the British Corporation for their highest class. The machinery consists of triple-expansion engines, having cylinders 25 in., 41 in. and 68 in. by 48 in. stroke, and three single-ended boilers with a working pressure of 180 lbs. per square inch.

Minimbah.—On December [illegible]th, there was launched from the yard of Messrs. Murdoch & Murray, Port Glasgow, a steel twin-screw steamer for the river and coasting trade of the North Coast Steam Navigation Co., Ltd., Sydney. The vessel which has the highest class at British Corporation, was named *Minimbah* by Miss Paton, daughter of one of the partners of Messrs. Paton & Hendry, the owners' representatives in this country, and immediately after the launch the vessel was towed to Glasgow where she will have her machinery fitted on board by Messrs. David Rowan and Co. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel has been applied to the peaks, chain locker, bunkers aft ballast tank and floors under boiler.

LAUNCHES—Irish.

Professor.—Messrs. Workman, Clark & Co. Ltd., of Belfast have launched from their south yard the steamer *Professor* built to the order of Messrs. T. & J. Harrison, Liverpool. The new vessel is 305 ft. in length and has a gross tonnage of about 3[illegible]. The *Professor* has been built under Lloyd's survey for the highest class in their Registry, and will comply with the Board of Trade requirements for a first-class cargo steamer. The cargo space is divided into four holds each of which is furnished with a large hatchway having steam winches, derricks and the other appliances necessary for efficiently handling general cargo. A number of comfortable state rooms for passengers have been arranged in the bridge deck house with the dining saloon in the centre of the vessel. The vessel is lighted by electricity and is fully equipped throughout for general cargo service. The propelling machinery consists of a set of triple-expansion engines with a complete set of [illegible] and the [illegible] ended cylindrical multitubular boilers.

Rangatira.—On December [illegible]th Messrs. Workman, Clark and Co. Ltd., launched from their north yard, Belfast, the large steel twin screw steamer *Rangatira*, which they have built to the order of the Shaw Savill & Albion Co., Ltd., London. The *Rangatira* is [illegible] ft. in length and has a gross tonnage of about [illegible]. She has been built under Lloyd's

special survey for their highest class, and will comply with all the requirements for a Board of Trade passenger certificate. The new steamer has been specially designed for the Company's special service between London and New Zealand. The cargo space is divided into five spacious holds, three of which have been insulated and otherwise prepared for the carriage of perishable cargo. For the preservation of these cargoes an extensive refrigerating plant has been installed. The holds are almost entirely free of obstruction, the decks being supported by fore and aft girders. Each of the holds is furnished with a large hatchway efficiently equipped with steam winches, derricks and other appliances necessary for expeditiously handling a large cargo. The machinery and boilers will be supplied by the builders, and consist of two sets of triple-expansion engines of the latest type, with steam supplied by five steel cylindrical multitubular boilers working under an improved system of forced draught. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering has been applied to tank top in boiler-room tunnel and refrigerating engine-room.

Pyreneu.—On December 22nd, Messrs. Workman, Clark and Co., Ltd., Belfast, launched from their North Yard the new steamer *Pyreneu*, the ninth vessel built by them for the Lloyd Brazileiro of Rio de Janeiro. The *Pyreneu* is 286 feet in length with a gross tonnage of about 1700, and has been designed to meet the requirements of the Brazilian coasting trade. She has been built under special survey for classification in the British Corporation Registry of Shipping. Each of the holds is provided with two extra large hatchways furnished with a couple of powerful steam winches, derricks and other appliances necessary for expeditiously handling general cargo. The officers' and engineers' rooms have been arranged in a large steel deckhouse amidships, with the captain's room on the deck above, while the crew are berthed in the topgallant forecastle. The vessel will be propelled by two sets of triple-expansion engines with the necessary auxiliaries and having steam supplied by two cylindrical multitubular boilers.

Minas Geraes.—On December 20th, Messrs. Workman, Clark & Co., Ltd., Belfast, launched from their South Yard a handsomely-modelled steamer, the eighth vessel built by them for the Lloyd Brazileiro of Rio de Janeiro. The new vessel has been named *Minas Geraes*, and is a sister ship to the *Sao Paulo* and *Rio de Janeiro* which left Belfast a short time ago. She is 356 feet in length, with a gross tonnage of over 3500. She is being built under Lloyd's special survey for the highest class in their registry, and complies with the Board of Trade requirements for a foreign-going passenger steamer. The steamer is intended for passenger and cargo trade between the principal ports of the American continent, and the special requirements of this trade have received full consideration at the hands of the designers. The private and public rooms throughout the vessel are replete with all the latest ideas for ensuring the comfort of travellers. The cargo holds, four in number, are each efficiently equipped with a couple of steam cranes, capable of expeditiously handling a general cargo. One of the 'tween deck spaces has been fitted up and suitably insulated for the carriage of perishable cargo, and similarly prepared chambers are provided for the stowage of provisions and vegetables for consumption during the voyage. For the preservation of this cargo and stores an efficient installation of refrigerating machinery has been provided. The propelling machinery of this vessel consists of two sets of triple-expansion engines, with three steel cylindrical multitubular boilers working under an improved system of forced draught.

TRIAL TRIPS.

Posteiro.—The steel twin-screw steamer *Posteiro*, built on the Tyne to the order of Messrs. Pile & Co., of London, on behalf of the Empreza de Navegacion Sul Rio Grande do Sul, has just completed a most satisfactory trial trip, averaging a mean speed of 11½ knots. The vessel which has been specially designed to carry a large deadweight on a light draught of water, is classed 100A1 at Lloyd's under their new rules. The principal dimensions are:—Length, 285 ft.; breadth, 43 ft. 6 in.; and depth moulded, 17 ft. 6 in. The propelling machinery is of the twin-screw triple-expansion type, having cylinders 15 in., 25 in. and 41 in. in diameter by 27 in. stroke, steam being supplied by two boilers 14 ft. 6 in. diameter by 10 ft. 6 in. long.

Chiloe.—The new steamer *Chiloe*, built by Messrs. A. Rodger & Co., Port Glasgow, has run her official trials on the measured mile at Skelmorlie. The engines worked with the greatest smoothness, there being almost complete absence of vibration, and the steamer developing a speed of 12·78 knots. She is of 2,380 tons deadweight. See Launches, December.

Constantine.—The screw steamer *Constantine*, built by the Blyth Shipbuilding and Dry Docks Co., Ltd., for Messrs. J. Ridley, Son & Tully, of Newcastle-on-Tyne, has been taken to sea for trial. This vessel, which measures 245 ft. in length with a beam of 36 ft. 9 in., has been constructed under Lloyd's special survey to class 100A1. She is of the raised quarter-deck type, having long bridge and topgallant forecastle. The *Constantine* is specially adapted for the Hamburg coal trade, having extra large hatches and clear holds arranged so as to embody the best and most modern improvements for self-trimming. A special feature on the *Constantine* is the arrangement for discharging cargo. Eight powerful winches of the latest type are placed on a raised platform, and in addition to the main derricks there are twelve gaffs fitted. Triple-expansion engines of good power have been supplied and fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend, cylinders 19 in., 31 in. and 51 in. by 36 in. stroke, working at 180 lbs. pressure, steam being supplied from one large boiler. The representatives of owners, builders and engineers on board were highly satisfied with the results obtained on vessel being run over the measured mile. A Cochran (Annan) donkey boiler has been supplied and fitted.

Queen Maud.—On December 10th, the finely-modelled steel screw steamer *Queen Maud*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order Messrs. Thos. Dunlop & Sons, of Glasgow, left the Tyne to undergo her official trial trip. The trial trip proved in every way satisfactory, and a speed of over 11½ knots was easily obtained. After the trial trip the s.s. *Queen Maud* proceeded to Rosario, under the command of Captain Ritson. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering has been applied to the tank top in boiler-room.

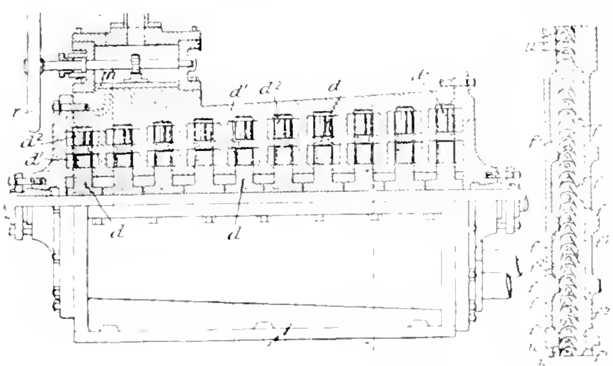
Metapan.—On December 21st, this steamer left Belfast Harbour and proceeded to the Carrick Roads for adjustment of compasses, after which she underwent her speed trials over the measured mile. These proved highly successful, and the vessel afterwards left the Lough for her voyage to the West Indies. For further particulars see November issue.

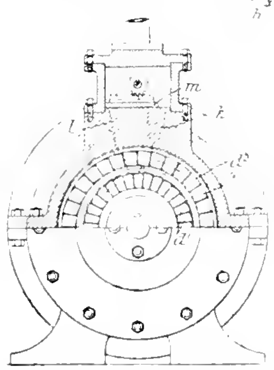
THE IRON AND STEEL INSTITUTE. THE ANDREW CARNEGIE RESEARCH SCHOLARSHIP.—A Research Scholarship or Scholarships, of such value as may appear expedient to the Council of the Iron and Steel Institute from time to time, founded by Mr. Andrew Carnegie (Past-President), who has presented to the Iron and Steel Institute one hundred thousand dollars for the purpose, will be awarded annually, irrespective of sex or nationality, on the recommendation of the Council of the Institute. Candidates, who must be under thirty-five years of age, must apply on a special form before the end of February to the Secretary of the Institute. The object of this scheme of Scholarships is not to facilitate ordinary collegiate studies, but to enable students, who have passed through a college curriculum or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects, with the view of aiding its advance or its application to industry. There is no restriction as to the place of research which may be selected, whether university, technical school, or works provided it be properly equipped for the prosecution of metallurgical investigations. The appointment to a Scholarship shall be for one year, but the Council may at their discretion renew the Scholarship for a further period instead of proceeding to a new election. The results of the research shall be communicated to the Iron and Steel Institute in the form of a Paper to be submitted to the Annual General Meeting of members, and if the Council consider the Paper to be of sufficient merit, the Andrew Carnegie Gold Medal shall be awarded to its author. Should the Paper in any year not be of sufficient merit, the Medal will not be awarded in that year.

The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs. E. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

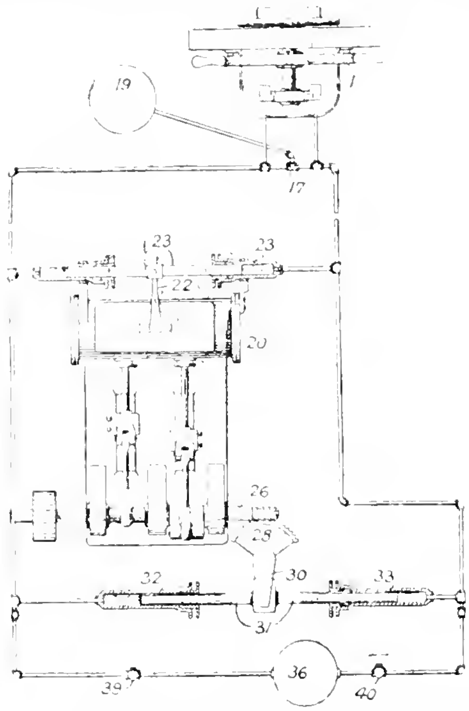
No. 18011, of 1908. Turbines.—Relates to turbines of the type comprising a vaned disc, on both sides of which there is a stator having its faces provided with pockets which act so as to redirect the motive fluid from side to side of the rotor, whilst flowing in a general circumferential direction. According to the present invention stator pockets are formed with symmetrical ends, and without directing vanes. A number of discs may be employed in series, the pockets gradually increasing in size to allow of expansive working. A double set of vanes and recesses may be provided, either arranged for opposite and alternative working, or arranged for working in series. The vanes are preferably formed so that the centre of the fluid passage is constricted. The rotor comprises a number of discs *d* having concentric rows of vanes d^1, d^2. On each side of the vanes, the stator is formed with pockets f^2, of gradually increasing





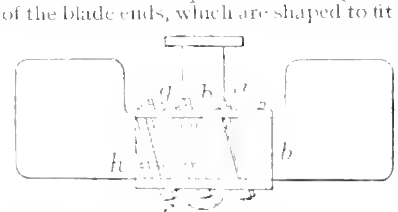
length, and with symmetrical ends *f*, f^1. Steam is admitted at *h* and passes through the blades to the opposite pocket f^2, whence it is redirected through the vanes to first pocket f^2 on the inlet side, and so on from side to side until it is finally exhausted to the next wheel. For ahead driving the outer rows of vanes are used, and for astern driving the inner rows. A reversing slide valve *m*, actuated by a hand-wheel *r* through rack and pinion gear, admits steam to the inlet port *k* or the inlet port *l*. Alternatively both sets might be used for ahead driving, the steam first passing through the inner series and then through the outer series. The vanes are constructed with central ridges or lumps *u*, which are stated to increase the impulsive effect of the steam on entering, and to increase the reactive effect on leaving the vanes.

No. 17774, of 1908. Hydraulic Telemotor Apparatus for Operating Steering Engines. In telemotor apparatus for operating steering-engines, etc., the operation of the steering engine sets up a counter impulse of liquid, which neutralizes the effect of the primary actuating impulse and stops the engine without disturbance of the means by which the primary impulse was imparted to the liquid. In the construction shown in Fig. 1 the valve lever 22 of a steering-engine 20 is actuated by means of a double acting plunger 23, which forms part of a telemotor system controlled by a steering wheel 1. The counter-impulse or displacement of liquid to return the plunger 23 to its central position is produced by means of the double-acting plunger 31, working in cylinders



32, 33 connected as shown with the valve-actuating telemotor system. The plunger 31 is actuated during the working of the steering engine by an arm 30 carried upon a toothed segment 28 geared with a worm upon the rudder-operating shaft 26. At the lowest point of the system near the cylinders 32, 33 there is provided a feed-tank 36 having communication with the pipe systems through non-return valves 39, 40. A high-level tank 19 may be placed in communication with both sides of the pipe system by means of a three-way valve 17, which normally closes a by-pass pipe between the pipe systems but is capable of being opened to refill and equalize the systems.

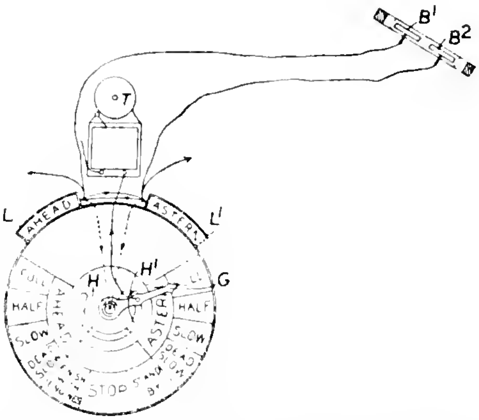
18,080, of 1908. Screw Propellers.—The forged wrought-iron or mild-steel boss *a* is provided with grooves *b* for the reception of the blade ends, which are shaped to fit the grooves.



The blades are further held in place by a cap *f* and split locking-ring *g*, the whole being secured by the bolts *h* passing through the blade ends.

17996, of 1908. Ships' telegraphs, etc. Electric lamps are used for signalling dis-accordance between the indication of a ship's order telegraph and the position of the engine reversing gear. Compartments L, L^1 on the telegraph instrument are provided each with a red and a white lamp. The white lamps indicate the position of the reversing-gear, for which purpose they are controlled by insulated contacts B^1, B^2 on the rocking shaft. The circuits of the red lamps are connected with contacts H, H^1 controlled by the telegraph pointer G, in such a manner that a red lamp is only lit up when there is variance between the telegraph indication and the position of the reversing gear. At the same time a bell

T rings. Thus, if the engine-gear is set for "astern" and the telegraph indicates "ahead," a white lamp will be lit in the "astern" box L^1 and a red lamp in the "ahead" box L.



The apparatus may be used in conjunction with means for recording the direction of movement of the machinery. Specification No. 205, A.D. 1887, is referred to.

INSTITUTE OF MARINE ENGINEERS.—A Bohemian concert was held at the Institute of Marine Engineers, Stratford, on December 10th, on the invitation of the Institute Lawn Tennis Club, the arrangements being carried out under the direction of Mr. J. H. Redman, hon. secretary of the club, whose efforts largely contributed in making the event a distinctly successful and enjoyable one. The programme opened with a pianoforte duet, very ably rendered by Miss C. Silver and Miss Smith, Miss Silver afterwards acting as accompanist throughout the evening. Miss Campbell found a congenial theme for her melodious voice in "The Scottish Blue Bells," and later in the evening she sang "Molly the Marchioness" with suitable vivacity. Mr. William Thurman followed with "Beloved, Awake!" and afterwards gave a spirited rendering of "The Drum Major," which received an enthusiastic and well-deserved call for an encore. A selection from "Pickwick," recited by Miss Robertson, gave a vivid impression of the genial Sam Weller composing his valentine, the charm of the written word being increased by the effective recital. Miss Robertson further contributed, in response to an appreciative encore, with a humorous piece "The Bald-headed Man." The selection "A Sergeant of the Line" was then very ably contributed by Mr. A. A. Dalton, who also gave "The Storm Fiend" as an encore. Miss Helen Weir's rendering of "Daffodil Time" was very much appreciated, and on being recalled she further contributed to the pleasure of the audience in "Robin Adair," sung with excellent effect. The feature of the second part of the programme was the performance of "The Peacemaker," described as "a comedy in one act," the artistes displaying histrionic ability of no mean order. The title rôle, that of a young lady who undertakes the difficult task of bringing together a young married couple who have been separated through "incompatibility of temper," by inviting both to a dinner party, was ably sustained by Miss K. Bugg, supported in her commendable endeavours by Mr. A. Robertson, who as Dr. Burton, one of the party, gave a very good portrayal of conflicting emotions, that of love for his hostess and the concern of a *gourmet* at being obliged to be called away to a fictitious patient "immediately after the soup." The frigid coldness of the victims of the conspiracy thus brought together and the gradual transition to a warm reconciliation were capitally shown by Mr. and Mrs. W. J. Marsham, while the naturalness of Miss A. C. Robertson, as Parsons, the maid, who would persist in making the mistakes common to the genus, and in effecting awkward entries and explanations at the wrong moment, was a delight to witness. Before and after the sketch, Miss E. Barnett, whose singing was of a high order and who was warmly encored, gave the solos "Peep o' Day," "The Cuckoo" and "Stars and Dreams." During the interval refreshments were handed round. A vote of thanks was accorded to the artistes on the proposal of Mr. W. E. Farenden, seconded by Mr. C. T. Ingersoll.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class 2C Second Class.

November 26th, 1909.

Aguirre, A	2C	Liverpool
Allen, R F	2C	Liverpool
Barrance, C.	1C	N Shields
Bowie, J.	1C	Greenock
Bowles, P	1C	London
Campbell, H	2C	Greenock
Cope, G. W.	2C	London
Crone, A. S. T.	2C	Aberdeen
Dempster, D.	2C	Greenock
Dove, E. W.	1C	London
Gray, A	1C	N Shields
Haley, T. H.	1C	Hull
Harper, S.	2C	Liverpool
Humphrey, E.R	2C	Liverpool
Jaggs, W R	2C	Hull
Johnson, J W.	1C	N.Shields
Kettle, D.	1C	N.Shields
M'Callum, G H.	2C	N Shields
Manley, V. L.	2C	Bristol
Percival, P	1C	Liverpool
Robson, D B	1C	Aberdeen
Sergeant, W R	2C	Sunderl'd
Simpson, R	2C	Sunderl'd
Starritt, D	2C	Greenock
Suddes, J H	2C	Sunderl'd
Torrie, W	2C	Aberdeen
Westhead, F.	1C	Liverpool
Wilkinson, E G	2C	Liverpool
Wilson, G. F.	2C	N.Shields
Young, G. G.	1C	London

December 3rd

Allen, J. W.	2C	Leith
Armstrong, A E.	1C	London
Beagle, J H.	2C	N Shields
Beynon, T	1C	Cardiff
Birnie, R.	2C	Liverpool
Birrell, W. J	2C	Leith
Boak, J M	1C	N Shields
Burch, T E.	2C	Liverpool
Burns, E	1C	Glasgow
Butler, W L.	2C	Liverpool
Byers, J A M.	1C	N Shields
Cameron, H	2C	Glasgow
Campbell, R F.	1C	Leith
Clark, J.	2C	N Shields
Coates, S B	1C	Belfast
Coslett, J C.	2C	Liverpool
Cuttle, H H.	1C	Liverpool
Develin, P. J.	1C	Belfast
Drewett, E. H.	2C	Cardiff
Drummond, W	1C	Leith
Erskine, J. C	1C	Glasgow
Evans, A	2C	Cardiff
Fay, H	1C	Liverpool
Fellows, W H G.	2C	South'ton
Forsyth, A Y.	1C	Leith
Gazdar, S. M	2C	Belfast
Hall, J. D.	2C	Glasgow
Harding, E.	2C	South'ton
Hart, E J	1C	Liverpool
Heatley, T	1C	N.Shields
Heron, T.	1C	N.Shields
Hill, C. M.	1C	London
Hughes, W	1C	Glasgow
Hughes, W	2C	Glasgow
Hutton, G M	1C	Glasgow
Mathieson, W D	2C	Glasgow
Mercer, W	2C	Glasgow
Mitchell, A M	2C	Liverpool
Moore, T E	2C	N.Shields
Nicholson, F. L	2C	Glasgow
Parr, E A	1C	Liverpool
Phillips, W T.	1C	South'ton
Pitman, G H	1C	Cardiff
Ramsay, A	2C	Glasgow
Ramsay, J	1C	Glasgow
Rutherford, J	2C	N.Shields
Ruxton, W	1C	Glasgow
Sadler, H	2C	Cardiff
Smith, C. J.	2C	Glasgow
Smith, D C.	2C	Leith
Sutherland, A	1C	Glasgow
Thirkel, F. A	2C	London
Weir, J.	2C	Glasgow
West, F. W. J.	2C	London
Wilkins, J A	1C	London
Williams, E. T.	1C	Cardiff
Williams, F. B.	1C	Cardiff
Young, R. H.	2C	Glasgow

December 10th.

Bowman, G C.	1C	Liverpool
Chrystie, J. J.	2C	Liverpool
Evans, B. E.	1C	Liverpool
Farnie, L. J. J.	1C	London
Forshaw, W D	1C	Liverpool
Foster, T.	1C	N.Shields
Frost, F. C.	2C	N.Shields
Garner, G	1C	London
Lamberd, W.	2C	N Shields
Linklater, J M	1C	Liverpool
Miller, D	2C	London
Ollett, J. E	2C	N Shields
Owen, E. H	2C	Liverpool
Peck, W. W.	1C	Liverpool
Pentelow, J O	2C	N Shields
Quincey, N. H	2C	Liverpool
Rainey, R A	2C	London
Scott, J.	2C	N.Shields
Strawson, C.	2C	London
Strong, J G.	1C	N Shields
Thompson, G R	2C	N Shields
Tytler, J	2C	N.Shields
Venables, G. B	2C	Liverpool
Viehoff, I C.	2C	Liverpool
Welsh, A. D	2C	Liverpool
Wickes, J. W	1C	London
Young, A. G.	2C	London

December 17th

Bell, R	2C	London
Brown, J L	2C	Greenock
Brown, W H	1C	Liverpool
Clark, R	1C	Greenock
Collingwood, J.	1C	Greenock
Cozens, A E.	1C	N.Shields
Deans, A D	1C	N.Shields
D'Orsey, W F.	2C	Hull
Dunn, J H	1C	Hull
Fathers, J B	2C	Hull
Finlay, F	2C	Greenock
Fraser, F L	2C	Liverpool
Gibb, W S	2C	Liverpool
Hampson, R J.	2C	London
Harris, A.	1C	N.Shields
Higginbotham, G	1C	N Shields
Jones, G M	1C	London
Jones, J. S.	1C	Liverpool
Jordan, J E.	1C	Hull
Kernaghan, E.	2C	Dublin
Lamont, F. A	2C	N Shields
M'Master, R	1C	London
Nell, G. M.	2C	Hull
Nicoll, G S.	2C	Dundee
Orritt, S	1C	Liverpool
Peel, F.	2C	N Shields
Rewcastle, R	2C	N Shields
Ritchie, J	2C	Greenock
Roscoe, P	1C	Liverpool
Scobie, T G	2C	Liverpool
Small, J D	2C	N Shields
Smith, C F.	2C	Liverpool
Spence, A T	2C	Greenock
Stewart, J	1C	Greenock
Trengove, G H	2C	London
Turnbull, A	1C	Hull
Vincent, T W	1C	London
Watson, J	1C	Greenock
Will, J	2C	Dundee

The Marine Engineer

And Naval Architect.

LONDON, FEBRUARY, 1910.

ALLOYS

IT was sometime in the eighties of the last century that a definite opinion became general among engineers and others dealing with metals and their alloys, regarding the necessity of organised and systematic research into this subject, with the result that the Institution of Mechanical Engineers set up an "Alloys Research Committee," which has carried on the work and reported from time to time. The first report was issued in 1891, and the ninth report was read last month at a meeting of the members of the Institution. In the eighth report the results of an extensive research into the properties of the alloys of copper and aluminium are described, and the authors, Messrs. Carpenter and Edwards, state that they had carried the research to a point where a way is clear for investigating the influence of a third metal. The authors of the ninth report, Dr. Rosenhain and Mr. F. C. A. H. Lantsberry, therefore took up the investigation of the influence of a third metal on the alloys of copper and aluminium with specific reference to manganese, nickel and zinc. The subject was so vast that the report is not considered in any way as an exhaustive treatise, but a large number of data of direct practical interest have been accumulated, particularly as regards the mechanical properties of some of these alloys, together with sufficient data as to their nature and composition, to be adequate for many practical purposes. Space will not allow of our dealing in any detail with the subject, and without such detail the treatment would be useless, but we feel it our duty to call attention to the matter so that those interested may take steps to obtain full information as to the report and the discussion upon it.

While we are on this particular subject, we should like to refer to the variation in working conditions of alloys brought about by the adoption of high-speed machinery. Evidence has been forthcoming that alloys which previously, under less onerous conditions, have served their purpose well, have, under the altered conditions now obtaining on turbine steamers and other vessels fitted with high-speed machinery, failed to have any really effective life, owing to the extensive erosive action that has exhibited itself. A notable example of this is the wing propellers of the *Mauretania*, which, at the end of three months, had to be replaced by new ones, owing to the weakening effect on the blades by erosion. It is probable few have realised the fact that the tips of the propeller blades of this ship have a speed through the water of 105 miles per hour, or the possible effect of such speed on the alloy of which the blades are made. We would direct attention to a treatise on the subject by Dr. Silberrad, which we give on another page, not only as the record of actual things that have happened, presenting serious difficulties to be overcome, but also the fact that a solution appears to have been found, judging from the results of extended trials that have taken place. This matter of itself points strongly to the necessity and value of alloy research, and, in our opinion, every possible encouragement should be given to such work, as the results are of a very far-reaching character in dealing with the new mechanical problems which are always presenting themselves.

GRAVING DOCK AT DOVER

A SERIOUS drawback to the mercantile marine exists in the want of graving dock accommodation between the Thames and Southampton, particularly as the Straits of Dover are the most dangerous part of the Channel and accidents are of frequent occurrence, while the constant repair work of the cross-channel steamers has to be almost entirely effected abroad owing to the lack of facilities at Dover.

Steps were taken a year or two ago by a private company to obtain Parliamentary powers to construct two graving docks at Dover, one of which was to be 950 feet long. Objection, however, was made by the Admiralty, judging from a letter written by the solicitor of the company to one of our contemporaries, on the ground that the flow of water into the naval harbour through the gap in the Prince of Wales Pier would be affected, and consequently one dock was abandoned and the other was shortened to 400 feet, and a plan was agreed on indicating a line seawards, beyond which the promoters could not go; but they were informed that so long as the works were kept within this line the Admiralty would not mind what they did. We understand on this basis the terms were arranged with the Admiralty, who withdrew their objection to the bill, which accordingly received the Royal assent. Subsequently negotiations were entered into between the promoters and the Dover Harbour Board, over which latter the Admiralty have no jurisdiction, whereby land inside the agreed line was to be acquired enabling a dock 700 feet long to be constructed almost entirely on dry land and within the line. Under the Act plans of the proposed works have to be submitted to the Admiralty, and such plans now include 400 feet over which the Admiralty have jurisdiction, and 300 feet of dry land over which they have no jurisdiction, the 400 feet representing the same area already approved by the Admiralty. We understand that the Admiralty now refuse to pass such amended plan of the dock, on the grounds that such will tend to overcrowd the harbour with large ships; the exposed position

of the dock might render it dangerous in time of war to a ship which could not get out in case of need, and the absence of facilities for repairs on a large scale. As the Company's solicitor points out, as to the first, a damaged ship makes for the nearest port whether the Admiralty approve of it or not, and in other cases arrangements are made long in advance and the dock is free when the vessel arrives for repairs, and she goes straight in. If the second objection is a valid one, then the adjoining Naval Harbour, which has been constructed by the Admiralty at a cost of several millions, should never have been made. Dealing with the third objection, it is pointed out that this is not a matter with which the Admiralty have anything to do, and, further, it is obviously absurd that any commercial body would expend a large capital in constructing a graving dock without making proper provision for workshops and repairing plant, particularly as this is a branch of the business which would give a very profitable return on the capital invested.

Now while admitting that the amended scheme is a different proposition to that agreed to on the Bill, and therefore requires the serious consideration of the Admiralty, still having regard to the fixing of the agreed line, and the new work being within such line, it does seem to us that the refusal to pass the amended plans on the grounds set forth is hardly the kind of administrative policy which one expects from such a body as the Admiralty Board. Unless there is something more at the back of the matter than has appeared to the public as yet, we would express a strong hope that better counsels will prevail, and the matter be furthered rather than impeded by the powers that be. The provision of such a graving dock would not only be a great advantage to ships disabled in the Channel, but the loss of time and expense to the owners in bringing ships either to the Thames or Southampton would be saved. Again, much money which is now spent across the water in repairs to the cross-channel steamers would be kept on this side, and a large amount of work would be available for men in Dover and the vicinity. Looking at the matter in its broadest sense, the scheme, if carried out, would be a distinct national asset, both from a commercial and naval aspect, and, unless some better grounds for refusal are forthcoming, we hope the promoters will press their point for the passing of the amended plans.

THE INSTITUTION OF CIVIL ENGINEERS: STUDENTS' MEETINGS.—At the students' meeting held at the Institution on 7th January, Mr. Henry R. J. Burstall, M.Inst.C.E., in the chair, Mr. Donald Southwell Richardson, Stud. Inst.C.E., read his paper on "Oil Fuel." The author, having described the various oil fuels, proceeded to discuss the economic advantages of oil over coal. He concluded with a description of the various methods of burning the oil and illustrated his remarks with a number of lantern slides of oil-fuel burners. In the discussion which followed, Messrs. G. Ingram, F. W. Cockshott, H. V. Hutt, S. Lacey and J. L. Tann took part.

ON THE EROSION OF BRONZE PROPELLERS.

By OSWALD SILBERRAD, Dr Phil, M.R S.A, F.C.S., etc

SINCE the introduction of high-speed turbine engines the phenomenon of erosion in propellers of high-tension bronze, which was, until recently, practically unknown, has forced itself upon the notice of those interested in shipbuilding.

Hitherto the bronze manufacturer has been chiefly occupied in overcoming corrosion, both chemical and galvanic. The improvements in engines and the demand for high-speed ships, both for the purpose of war and peace, have led to conditions never before dreamed of. On the one hand we have to consider the high-speed propellers of our torpedo boat destroyers, some of which are capable of making 700 to 800 revolutions per minute; and on the other the great four-bladed solids which propel our gigantic liners.

As generally happens when a material, which has hitherto proved perfectly satisfactory for a given purpose, is subjected to new conditions, something suffers, and so has it proved in the case of these propellers.

Perhaps the most remarkable instance has been that of the propellers of the Cunard liner, *Mauretania*. Some three months after her maiden voyage she was dry docked, and it was found that all the propellers were very badly eaten away. Of the four, those at the stern were least affected. In all cases the area that had suffered most damage was situated about 2 feet from the root and towards the after edge of the blade. In extent it amounted to 3 or 4 square feet, and in depth varied from a quarter of an inch to as much as 2½ inches in places. The damaged surfaces presented somewhat the appearance of galvanic action.

The edges of the blades also showed eroded areas. Many of these could apparently be traced to a chip or damage at the edges. In shape they were curved, in most cases on an arc described from the centre of the propeller shaft. On the back, with two exceptions, the blades showed the same curious comet-shaped marks, in some cases, commencing at the shackle holes. These holes do not appear to have started similar areas of damage on the driving face, and in two cases no such mark was apparent. The extent of this part of the damage would appear to depend upon the length of time during which the plug remained out of the shackle hole.

The condition of the bronze on the driving face was excellent, showing a smooth, crystalline surface (probably due to the etching effect of the water), but no signs of corrosion.

As will be readily understood, the weakening effect of this deterioration is remarkable. Thus a portion of a damaged propeller from the s.s. *Lusitania* was broken off across the line of maximum deterioration, and on examining the fracture it was found that the line of compression was situated right against the un-eroded side.

These details may, broadly speaking, be regarded as typical of an extreme case, so having briefly touched upon the nature of this deterioration let us now deal with a few possible causes.

Since the material withstood the old conditions it is obvious that the primary cause of the deterioration described must be sought in the modified conditions. The problem thus arises as to what these modified conditions are, and in what way they affect the question at issue.

In the first place, we have to consider the terrific surface friction of the water. To illustrate this let us take a few figures, and for this purpose we cannot have a better example than the above mentioned liner, *viz.*, the s.s. *Mauretania*. As is well known, this ship was originally fitted with four three-bladed, built-up propellers, of the usual standard high-tension bronze that has been employed for many years for the propellers of Atlantic liners and war vessels of all descriptions. These propellers were somewhat under 17 feet in diameter. Upon the outward journey the average revolutions of the engines were 174, the horse-power developed being about 68,000, and the speed of the vessel nearly 26

Section of a Bronze Propeller of Torpedo Boat Destroyer with Turbine Engines, showing [illegible] Surface Erosion

knots. It is evident, therefore, that the perimeter of each propeller travelled through the water in a helical path of approximately 154 feet per second, or 105 miles per hour, and transmitted to the water no less than 1700 h.p. the whole time. A consideration of these figures at once enables us to realize that under such conditions the water becomes a very rough file for any alloy to withstand, and when the standard bronze, which has proved so serviceable in the past, was subjected to these conditions we can scarcely be surprised that it failed.

So far so good, but now we come up against the extraordinary discrepancies between the various propellers examined. While of the propellers examined nearly all showed more or less deterioration of a similar nature, yet in degree and position there were wide and marked divergencies. Thus in the case of the *Mauretania's* sister ship, the s.s. *Lusitania*, where the conditions are at first sight identical, the backs of the propellers were quite as much affected as the faces. Still more remarkable is the case of certain destroyers the propellers of which show a maximum damage at the base, where the helical velocity is at a minimum.

This led to a search for secondary causes, a few of which may well be briefly touched upon.

(1) Dirt in Castings. This may be dismissed at once. Not only did the propellers examined include some of the cleanest castings the author has ever inspected, but seldom did the maximum concentration of oxide or dirt coincide with the area of maximum damage.

(2) Galvanic Action. In the case of the s.s. *Lusitania* the stern propellers were much less affected than the wing propellers, whilst the conditions, in so far as they affected the zinc plates, were exactly reversed, those at the stern being far more eaten away. From this it was at first thought that galvanic action played a part in the deterioration. The appearance of the damaged area was strongly in favour of this theory, the metal having been eaten and pitted in a most remarkable manner, sponge-like masses as much as 1¼ inches in diameter being left attached by a base of less than a quarter of an inch across, whilst all the surrounding metal had been eaten out.

Analysis, however, rendered it evident that no large concentration of copper had occurred on the eroded surface, so that if galvanic action enters into the problem and tends to cause a concentration of a softer alloy much richer in copper, this effect appears to be more than counterbalanced by the erosive action of the water as it sweeps over the surface. At the same time, the areas of maximum deterioration do not coincide with the view that erosion is alone the primary cause, for in no case do these areas occur at the extreme tips of the blades where the helical velocity is greatest.

With facts of so conflicting a nature it appeared obviously unsafe to hazard an opinion as to the nature of the action in all cases. A large number of instances were accordingly submitted to the most minute examination, every cause possible and impossible being taken into account. The details of these prolonged researches would prove far too tedious to recapitulate. It will suffice to say that the specific nature of the trouble ultimately proved to be primarily erosion, though the degree to which secondary causes entered in varied far more widely than could have been anticipated.

We need not delay to point out the many useful conclusions that may be drawn from the results, but only to remark in passing that our knowledge of the nature of eddies and the amount of energy absorbed thereby has been greatly enriched.

The problem thus resolved itself into (*a*) the production of an alloy better calculated to withstand the new conditions, and (*b*) the minimisation of the various causes.

This latter investigation obviously varies with each particular case, and need not, therefore, delay us further.

In order to deal with the first problem, conditions for the artificial production of this phenomenon in the laboratory were worked out and a very large number of alloys made, thoroughly examined, and then submitted to this test.

The following table gives the figures obtained in a few instances :—

Table showing Relative Resistance to Erosion of a few of the Alloys examined.

Designation of Alloy.	Time taken to Produce Standard Deterioration under Standard Condit'ns. Hours.	Physical Properties of Alloys.			
		Ultimate Strength. Tons per sq. inch.	Elastic Limit. Tons per sq. inch.	Elongation %	Hardness. Brinell's Figure.
Standard High Tension Bronze (various makers)	24,700				—
Alloy No. 188 ..	30,900				—
Alloy No. 190 ..	39,700				—
Alloy No. 287 ..	33,600				—
Alloy No. 298 ..	43,200				120
Alloy No. 351 ..	32,300	32—34	16—18	12—20	166
Alloy No. 528 ..	46,650				173
Alloy No. 660 ..	50,900				99
Alloy No. 955 ..	57,000				131
Alloy No. 1003 ..	64,800				132
Parsons' New Turbine Alloy..	117,200	33—34	18	12—15	131

From the above the following conclusions may be drawn :—

(*a*) That the capacity to withstand this deterioration is not, strictly speaking, dependent on any one physical property, but must rather be regarded as a property peculiar to itself ; in short, it would appear to constitute a new physical constant for alloys.

(*b*) That in the new alloy (" Turbine Alloy ") this property has been brought to a remarkable pitch, its resistance to the action under standard conditions being nearly five times as great as that of the old alloy, from which it will be seen that the new alloy is likely to resist all reasonable conditions of wear indefinitely.

The elementary difference between these two alloys is remarkable. Its efficiency depends upon certain treatment of the alloy, and the addition of certain new elements which we may unhesitatingly state have not hitherto been brought under consideration as a possible solution of a problem of this nature.

Interesting instances, illustrative of the superiority of the new alloy, have been afforded by certain destroyers. In one case the ship was first fitted with propellers of ordinary high tension bronze ; these, after running at full speed for sixteen hours, showed such marked and serious erosion that the speed could not be maintained. They were then replaced by a new set cast in Turbine Alloy, which have proved fully equal to the demands put upon them.

Indeed, the efficiency of the new alloy has now become a matter of history. The first propellers made of it were the new solids for the s.s. *Mauretania*. To those who inspected the old propellers after running for three months the superiority is scarcely to be believed. After running for twice as long the present solids are still like new, indeed they bid fair to outlast the ship.

In this connection the following report of Mr. Wm. J. Norris, Surveyor for Germanischer Lloyd, may be quoted as being of great interest.

Certified copy of Report received from Mr. W. J. Norris " On some propellers of Parsons' special Turbine Alloy supplied by the Manganese Bronze and Brass Company, Limited, to the Cunard Steamship Company for the R.M.S. *Mauretania*.

" To the Manganese Bronze & Brass Co., Limited,
116, Fenchurch Street, E.C. 1st July, 1909.

" Dear Sirs,—In accordance with your request, I proceeded to the R.M.S. *Mauretania* in the Canada Dry Dock, Liverpool, on Tuesday last, to inspect the new wing propellers lately supplied by you of your special ' Parsons' Turbine Alloy.'

" I understand that these propellers were specially made by you to take the place of other propellers of the ordinary

standard high-tension bronze, as used for the propellers of the principal Atlantic liners, which had proved subject to erosion, apparently resulting from the high revolutions of the engines, combined with the action of broken water under high pressure upon the surface of the blades.

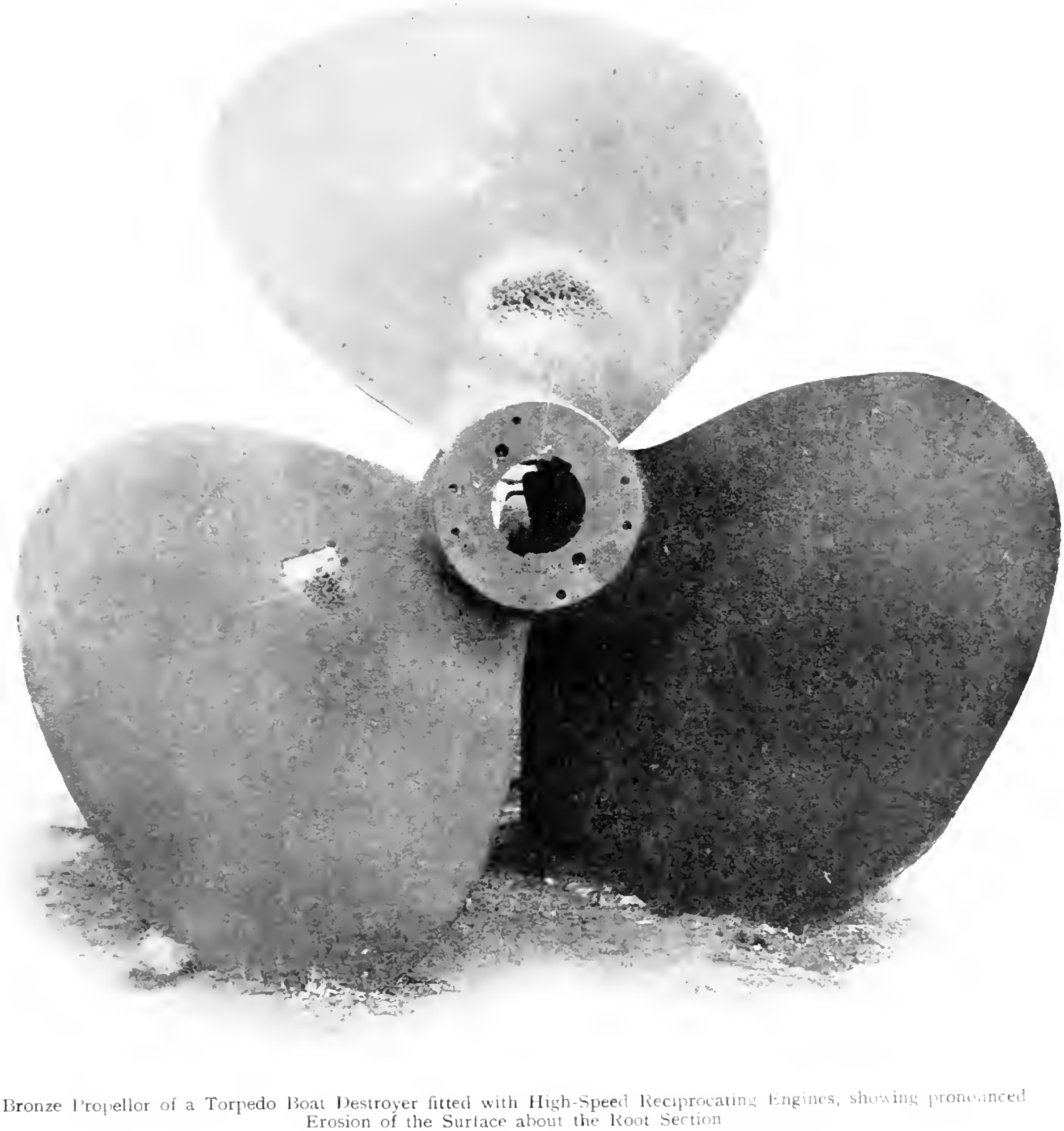
"I learnt from the Cunard Steamship Company, that the new wing propellers referred to were fitted in January last, and have, therefore, been running for nearly six months. After a thorough examination of these propellers, I found erosion would very soon have worn out these blades.

"I consider it, therefore, a matter of great scientific interest, and one upon which you can be congratulated, in having been successful in producing an alloy which, from the inspection carried out by me, appears to withstand the erosion so satisfactorily."

"Yours faithfully,

"(Signed) WM. J. NORRIS,

"Surveyor for Germanischer Lloyd."



Bronze Propellor of a Torpedo Boat Destroyer fitted with High-Speed Reciprocating Engines, showing pronounced Erosion of the Surface about the Root Section

them in perfect condition, there was no sign of wasting or erosion, the surface in fact appeared to be as good in every way as when the castings were first made.

"While in Liverpool I also examined the blades of the built-up propellers previously fitted to this vessel, and noted with great interest the very extensive erosion which had taken place over a great part of the surface of the same.

"These blades, I was informed, had only made three round trips, so that it was obvious such a severe and rapid

When the s.s. *Mauretania* was first fitted with solid wing propellers of this material (each weighing nearly [illegible] tons) she, as is well known, beat all previous Transatlantic records. Now that the s.s. *Lusitania* has been similarly equipped we see that there will be keen competition between the two ships. It is rumoured that the Cunard Company propose shortly to replace the *Mauretania's* stern propellers also, so that the duration of the journey to New York is likely to be still further reduced in the near future.

In conclusion, I should like to thank the directors of the Manganese Bronze and Brass Company, Limited, and those of the Cunard Steamship Line Company, and Messrs. John Brown & Co., for the hearty assistance and facilities they have given me for carrying out this work, and I may add that the success of this investigation has been largely due to the great knowledge of bronzes and allied alloys possessed by the managing director of the first-named Company.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The late Sir Alfred Jones.

In the obituary notice of Sir Alfred Jones attention was directed to the extraordinary gift of imagination which characterized him, and to the way in which he turned every little incident to account. Perhaps a little personal illustration may be permitted to emphasize this point. When in London it was Sir Alfred's wont to entertain his friends at the Constitutional Club, and the last time I had the pleasure of lunching with him there, he handed me a little knife, with which I was to cut off the end of the post-prandial cigar. "Put it in your pocket and keep it," said he. This I did. But remembering the old superstition about friendship being severed by the gift of a cutting instrument, I handed him a farthing which I had just received in change at the neighbouring Post Office. "What is this?" he inquired. "Ah," I explained, "we do not see such coins in Lancashire, but in London they are common enough." Looking carefully at it, he handed it to one of his secretaries and suggested that it would be well to get into communication with the Colonial Office and see if a quantity could not be sent to the West Coast of Africa, where the provision of so much coin of so small a denomination would be likely to facilitate trade amongst the natives.

Though he transferred his interest in the St. Lawrence trade to the Canadian Pacific Railway, he never lost his interest in the Dominion, nor wavered in his belief that a great future lies before it. The last of many letters which I received from him was in reference to a young fellow for whom I was seeking an opening. "Send him to Canada," wrote Sir Alfred, "that is the one and only place. A great future lies before the country, and it is the one place to which a young man should go."

The wealth which Sir Alfred Jones acquired will be devoted to the public good. His executors are empowered to continue the various businesses in which he was interested, so that the dislocation caused by his loss shall be, as far as possible, minimised, and that the capital of his friends and the employment of his subordinates shall not be lost. This for existing circumstances. But after providing for his relatives and dependents, the bulk of his fortune will be devoted to the maintainance and extension of the research work in which his heart lay. He was indeed a public-spirited citizen!

Disasters.

As might be anticipated there is a considerable tale of disaster to record since the last issue of these notes. The Southern Pacific Railway Company's ss. *Czarina* met with an unlucky fate. She seems to have gone ashore near Coos Bay, but to have been subsequently refloated and anchored in apparent safety. Bad weather, however, ensued and she was driven on to the neighbouring jetty on the evening of Wednesday, the 12th January. The seas were too heavy to allow of assistance reaching the crew, who eventually were driven to take to the rigging. When darkness fell six men only remained visible. When daylight came on the Thursday morning three of these had disappeared, and the remainder in despair cast themselves into the sea, where they were quickly engulfed. Of all on board but a single person seems to have survived.

Another horrible disaster took place early in December on Lake Erie. A car-ferry, known by the somewhat cumbersome title of the *Marquette and Bessemer No. 2*, foundered in a gale some twelve miles out from Conneaut, Ohio. Some at least of the crew seem to have had an opportunity to take to the boats. But their agony was merely prolonged by doing so, for one of the ship's boats was eventually picked up with nine corpses lying in it. The hapless men had been frozen to death in the storm.

The Iberian coast claimed a heavy list of casualties during the closing days of 1909. First of all the Houlder Liner *Southern Cross*, a steamer of upwards of 5,000 tons gross register, built seventeen years ago at Belfast by the firm of Messrs. Workman, Clark & Co., was wrecked when entering the port of Vigo. But the bulk of the trouble occurred at Oporto when the river Douro rose, in consequence of up-country floods, some forty feet in a few hours. The current swept all before it, two Ellerman liners, the 1,000 tons *Douro*, built nine years ago at Dundee by the Caledon Shipbuilding Co., being driven out over the Bar, and dashed upon the Leixoes rocks, where she quickly went to pieces, and the slightly larger *Gascony*, built in the same year at Ayr by S. McKnight & Co., being lost on the Bar itself. Nine miles north of Oporto at Villaha the fine new steam trawler *Picton Castle* was lost on the rocks. She was only built in 1908, and was of 256 tons gross register. Another vessel of the same class the *Sachsen* of Bremen, built but five years ago at Bremerhaven, was driven on to the rocks of the Douro bar, whilst the fate of the Norwegian cargo vessel *Sylvia*, of Tonsberg, was equally hopeless, though she escaped the rocks and lay on the mud. The *Sylvia* was a comparatively new ship, built as recently as the year 1905 at Bergen, being of about the same tonnage as the *Gascon* already mentioned, and as the *Ellida*, of Bergen, which came from the same Bergen yard some four years previously. Other vessels lost were the *Cintra*, of Hamburg, and the steam tug *Veloz*, of Oporto.

Nearer home we had the disastrous collision between the *Arcadian*, also of the Ellerman line, and the twin-screw steamship *Ayrshire*, of the Federal line, off the Tuskar. The *Arcadian* sank almost immediately with the loss of some thirteen Lascars, who preferred to attempt to save their belongings to securing their own safety. But the remarkable feature of the disaster was the escape of the *Ayrshire*. So badly damaged was she forward by the impact, that her collision bulkhead gave out, and she with much difficulty made Holyhead, where she was beached for temporary repairs. How she was ever navigated into safety seems a marvel when we learn that she was drawing something like forty-five feet forward against but twenty-two feet aft when she fetched her port of refuge.

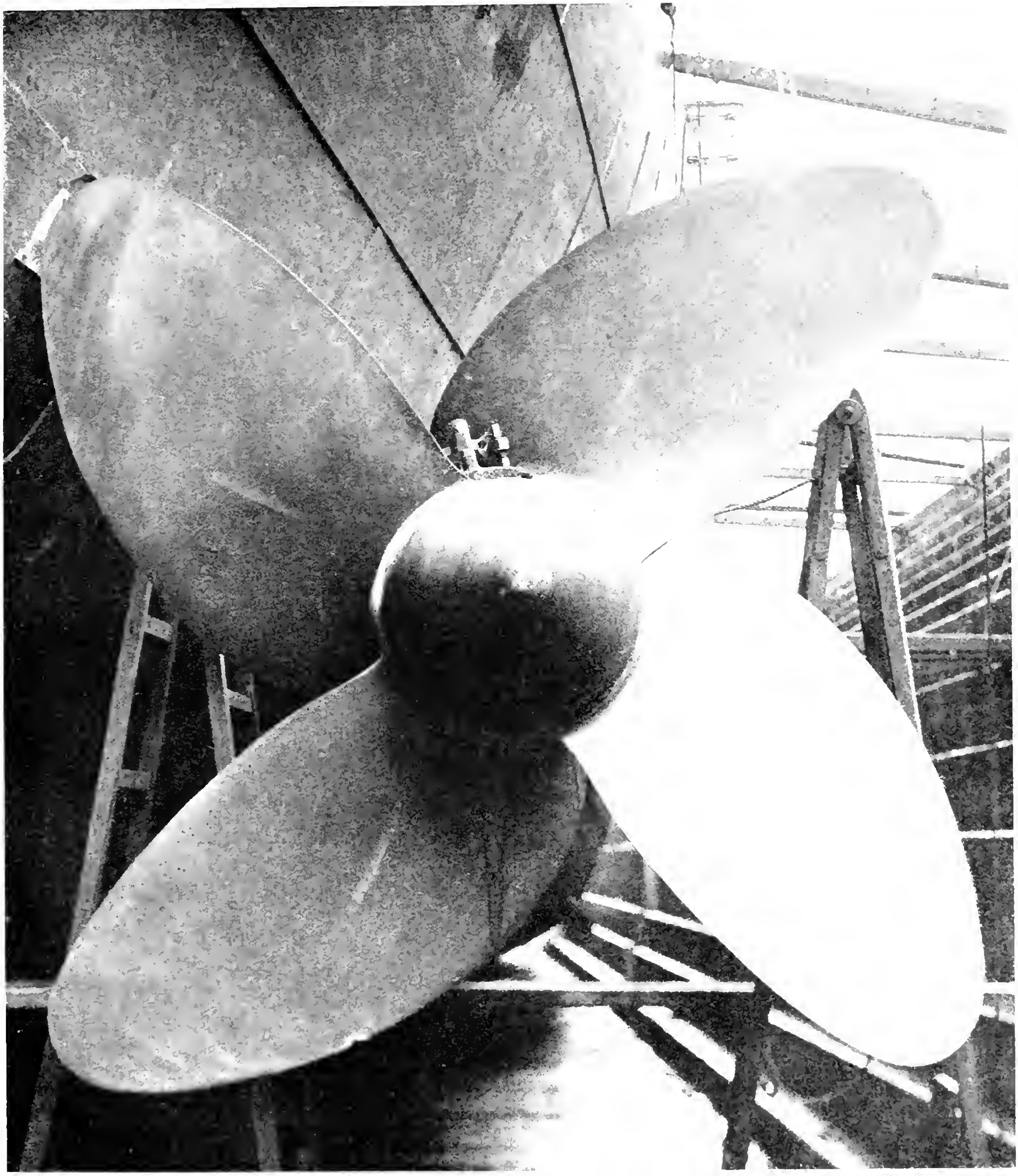
The melancholy list may be closed with a note of the loss by fire of the comparatively new Prince liner *Norse Prince* off the Island of Ascension on the 4th January. The crew were rescued by the Union-Castle liner *Guelph* and the cable steamer *Britannia* came out to see if anything could be done towards salvage. But the ship was already a mass of flames, and nothing could be done. She was allowed to drift rapidly into the ocean to the North-West of the Island, where she no doubt soon sank.

The "Waratah."

Though Lloyd's posted this unfortunate Lund liner as missing, immediately on the return of the Union-Castle liner *Sabine* from her three months' fruitless search, hope has not by any means been abandonned in Colonial circles. There seem to be two reasons for the faith that is in them. One is the fact that no wreckage has yet been found which could be identified as belonging to the missing vessel, and the other is the omission of those in charge of the *Sabine* to thoroughly explore all the islands which they passed in their cruise. A sum of about £5,000 is being raised, and the steamship *Wakefield* is to be shortly sent out for an exhaustive search.

The "Lucania."

I was at Swansea a few days ago, and went over the new docks, which have recently been provided there. To me the most interesting sight was the ill-fated *Lucania*, which is lying there at a quay in process of dismemberment. Though she was able to go round to her last resting-place from Liverpool under her own steam, she is already far gone. All her fittings have been removed and sold. Her funnels are gone and only her foremast remains, whilst her upper decks have been razed, and little remains above the side-plating. In a few weeks, when she is reduced to an empty shell, with just



One of the New Solid Propellers of R.M.S. *Mauretania*, manufactured at [illegible] Six Months, showing no Erosion on the Surface.

See "On the Erosion of Bronze Propellers" [illegible]

enough freeboard to keep out calm seas, she is to be taken out to be beached at Briton Ferry for the final stage of dispersal. So passes the great Atlantic record-breaker of but the other day. They say her machinery was in as good or better condition than it was when she first came out

The Compagnie Générale Transatlantique.

From a speech made by M. dal Piaz at a New Year's Day reception of the staff, the Company has made great strides of recent years. The passenger accommodation of the fleet has expanded from 17,300 persons in 1904 to 24,500 in 1909, whilst the cargo capacity has more than doubled. The mileage has increased by forty per cent., whilst the number of vessels in the fleet has risen from 54 to 75 vessels, the tonnage being 292,878 tons in 1909, against 171,217 tons five years previously. Meanwhile the book value of the fleet has been reduced by upwards of fifty per cent. Their large new liner *France*, building at the Penhoet yard, is to be completed in September, 1910, whilst the *Carthage*, under construction for the Tunis service in Messrs. Swan, Hunter & Wigham Richardson's yard on the Tyne, is to be delivered in August. From the yard at Port de Bouc there has just been launched a new liner named the *Espagne*, whilst tenders are now open for a sister to the successful liner *Chicago*. These facts are interesting to our readers. But the audience to whom the remarks were addressed was probably personally pleased to know of the increase in personnel and wages. The staff, sea-going and shore-staying, had increased some twelve per cent. in the five years, but owing to the increased activity of all concerned, the earnings had been augmented beyond the parity of numbers, the wages bill being up 21 per cent.

The "Lusitania"

seems to have made a heavy passage to the westward in mid-January. She left Queenstown on her regular voyage on Sunday the 9th, and did not reach New York till 11 p.m. on Friday the 14th, having thus been about five and a half days on the trip. On the second night of her voyage she was struck by a huge wave which seems to have done a good deal of damage to deck fittings and boats, and to have flooded the officers' quarters and the chart-house. The Atlantic takes care every now and then to remind shipbuilders that, though they may increase the size and power of their steamers, the might of the ocean, when roused, is beyond the puny dominion of man.

The "Orient."

A few weeks ago the arrival of the Orient liner *Orient* at Plymouth from her last mail voyage was announced in the press. The vessel has now been purchased by a firm of Italian shipbreakers. So passes the name-ship of the Company for which she was built and for which she has been working for some thirty years. She came from the Fairfield yard, and was re-boilered in 1898, when her compound engines were tripled by the Wallsend Slipway Co. The old ships of the Orient line—whichever side of the fleet claimed them—are thus rapidly disappearing from the active list.

The Japanese Mercantile Marine

is rapidly extending. The official figures for the year 1908-9 have just been published, and from them it would appear that already the Empire owns some 2,304 steamships of 1,160,440 tons gross register. These totals are an increase of 81 bottoms and of 44,247 tons on the corresponding figures of the previous year. They would seem to indicate that a considerable number of small vessels are being built. These are presumably for the coasting service amongst the numerous islands which constitute the group we know as Japan.

A New Atlantic Service.

Under the name of the Blue Star Line, is about to be inaugurated a service from Bordeaux to New York and Philadelphia, calling at Lisbon and the Azores. The steamers are to carry passengers as well as cargo, and the sailings are to commence in February. The vessels to be employed will be the *Notre Dame de Lourdes* and the *Jeanne d'Arc*. It would seem that at first the sailings will not be frequent—as, indeed, might be expected from the number of ports at which it is intended that the vessels are to call.

The White Star Line

has reduced its sailings during the winter months on the New York service. But it has not lowered the class of vessel employed between the Mersey and the Hudson, for the new Dominion Liner *Laurentic* was despatched from Liverpool to New York on the 18th December, as, of course, the St. Lawrence route was then closed. The experts of New York had thus an opportunity of seeing a vessel of the new type of machinery, the *Laurentic*, of course, being fitted with the combination turbine and reciprocating engines.

Wireless Telegraphy,

which has made so much progress on the Atlantic, is now in a fair way to be extended to South Africa, where Natal has already made arrangements for the construction of Marconi stations, and to Australia, where tenders for the provision of wireless facilities are being invited by the Government. Naturally, in view of this latter development, the P. & O. Company, who have fitted their new mail steamers with Marconi apparatus as they came out, have recently had similar provision made on board some of their older vessels, amongst others the *Egypt*, and have also arranged for the fitting out of the Bombay-Aden mail steamer *Salsette*.

SHIPWRIGHTS' COMPANY.—The Quarterly Meeting was held at the Master's (Lord Pirrie, K.P.) Offices, 1a, Cockspur Street, on Friday the 28th January, at 5 p.m., and the Court dined together afterwards at The Ritz, St. James's Park, W., at 8 o'clock.

MESSRS. G. RENNIE & CO., OF GREENWICH, launched from their works on the 12th January, the powerful twin-screw in tunnel tug *Bulbul* for Eastern owners, and on the 17th January launched the steel single-screw tug *Resource* for London owners.

JAPANESE INSTITUTION OF NAVAL ARCHITECTS.—The annual meeting of this body, which includes alike those responsible for warship and for merchant ship designing in the Island Empire of the Far East, took place last November, and was well attended, both in its business proceedings and in the social gathering that followed. Four papers were read at the former, the titles and authors being as follows :—On the development of fishing boats in Japan, by S. Kato, M.E., Inspector of Fishing Boats for the Imperial Fisheries Bureau. On Lloyd's Rules, their development and new departure, by J. Imaoka, M.E., Naval Architect to the Marine Bureau, Department of Communications. On Lloyd's New Rules, by F. P. Purvis, Prof. of Naval Architecture, Tokio Imperial University. On the oil burning arrangements of Tenyo Maru and Chiyo Maru, by Dr. S. Terano and Baron Shiba, Prof. of Naval Architecture and Prof. of Marine Engineering (respectively), Tokio Imperial University.

JAMES WATT ANNIVERSARY LECTURE.—The Watt Anniversary Lecture was delivered at Greenock on January 14 by Mr. Robert Caird, LL D , of the well-known Greenock shipbuilding firm of Caird & Co The title of the lecture was "James Watt's Contribution to the Advancement of Engineering." In the course of his address, Dr Caird made a survey of Watt's achievements from two points of view—first, the theoretical, the part he took in the investigations that led up to the science of thermo-dynamics, which is the basis of modern steam engine design ; and secondly, the practical, the contrivances by which power or force is directed or constrained to do any practical work After giving a review of Watt's experiments, Dr Caird concluded by directing attention to the greatest step in the advancement of engineering by means of steam appliances since the days of James Watt, the only original and revolutionary, as distinguished from evolutionary, step—the steam turbine of the Hon C. A Parsons Watt had considered forms of rotative engines by an axis turned round in the cylinder by the immediate application of steam, which is the ruling idea of the turbine, but he never put the idea into practice, and it is questionable if any of the three methods he covered in his specification of 1782 is practicable. The Parsons turbine is as original as any mechanical device can be—as original, for instance, as Watt's engine was relatively to Newcomen's—and we cannot fail to recognise in Mr. Parsons those distinguishing qualities which have built up the enduring greatness of James Watt's reputation

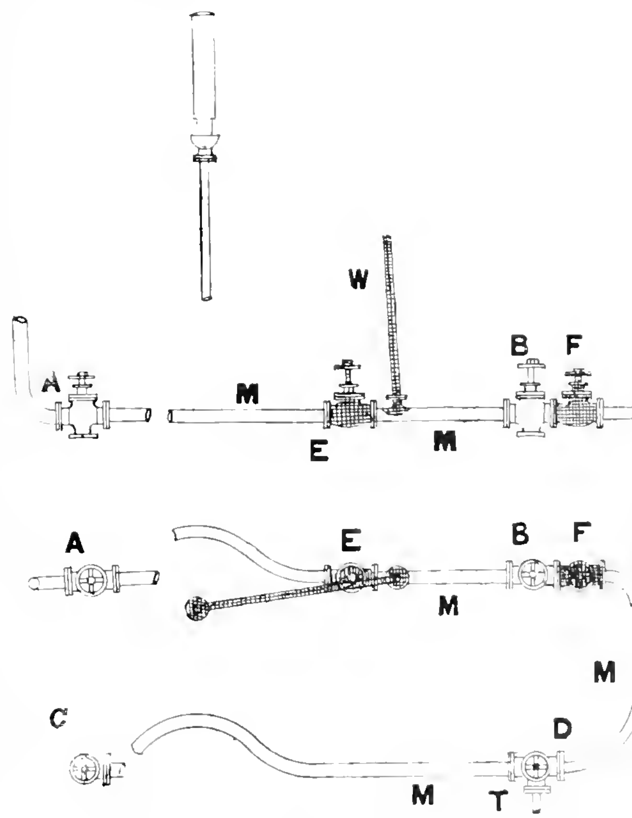
A DRY STEAM SUPPLY FOR WHISTLES.

THE presence of water in the whistle pipes on steamships is not only a serious source of annoyance to passengers, but detracts very largely from the utility of the whistle as an efficient signalling device. Efforts have been made in the past to drain whistle pipes of the condensed steam collected therein when the whistle is put into operation, but we know of no attempt hitherto made to provide for the supply of dry steam to the whistle under all circumstances. In these days of high-speed traffic across the ocean there is a strong necessity for facilities of ready and efficient means of signalling by sound, and any arrangement by which the squealing, spluttering sounds usually heard at the commencement of a blast, owing to the accumulation of water in the whistle pipe, can be done away with, will be appreciated, as such sounds must materially interfere with clear and reliable signalling, such as, for example, by the long and short blasts of the Morse Code.

In order to overcome the difficulties mentioned above, an ingenious method of supplying dry steam to whistles has been devised by Mr. J. H. Yates, Chief Engineer of the *S.S. New York*, belonging to the American Petroleum Company. This method consists essentially in such an arrangement of valves and pipes, adaptable to steamers of all classes, so that a swift current of steam is always passing across the lower orifice of the whistle pipe, thereby inducing upward and downward currents in such pipe continuously, and thus avoiding any collection of the water of condensation therein.

The accompanying diagram illustrates in elevation and plan a particular arrangement of pipes of an auxiliary steam main fed from four main boilers, which forms a good illustration of how Mr. Yates' method has been actually carried into effect, but it is quite obvious that many other arrangements could be devised to produce the same effect so long as the current of steam is allowed to pass continuously across the orifice at the lower end of the whistle pipe. The valves A, B, C and D control the supply of steam from four main boilers; the pipe S leads to the steering engines and the pipe T to the dynamo engine. In the auxilary main M, two stop valves E and F are inserted, and the particular part of the pipe M, between the valves E and B, constitute the whistle main from which the whistle pipe W is taken in a substantially vertical direction. It may be taken as a general rule that the steam for the whistle and steering engines are supplied through the valve B, in which case the valves A and F are kept closed, and the steam for the dynamo engine is supplied through the valve C or the valve D, or through both the valves C and D simultaneously. It will be noticed that the main current of steam from the valve B passes under the whistle pipe W on its way to the steering engines through the pipe S. The effect of this current of steam induces two currents in the whistle pipe W, one passing up the centre of the pipe and another of annular formation descending close to the walls of the pipe, so that a continual current of hot dry steam is kept up in the whistle pipe owing to the radiation of the heat of the steam through the walls of the pipes. In the conditions outlined above the valve F is kept closed in order to reduce the length of piping through which the radiation can take place. As a result of actual practical experience it has been found that if steam is taken from one boiler through the valve A alone both to the steering engine and to the whistle pipe W the particular action sought is not effected and the whistle pipe becomes nearly full of water.

The arrangement illustrated in the diagram is really a modification of the arrangement of valves and pipes in an existing range of steam pipes, the additional features being shown cross-hatched so that one can readily appreciate the small alteration necessary to effect the purpose. In new steamers where the pipes can be initially arranged to suit the special conditions, it is obvious that the pipe to the steering or other engine or apparatus constantly in use at sea would be led by way of a point as directly under the whistle as possible and disposed vertically or nearly vertically up to the whistle. It is suggested that in steamers using auxiliary engine or apparatus constantly at sea a special pipe may be fitted as a whistle main, exhausting into the main feed suction pipe so as to heat the feed water to any desired temperature.



Preventing Condensation in Whistle Pipes.
Elevation and Plan

We have seen copies of testimonials given by captains who have had the arrangement fitted on their steamers, and strong testimony is given as to the whistle being always free from water and the full

sound coming from the whistle instantaneously on the cord being pulled, whether this is done with intervals of days or minutes, and in addition the sound emitted is also clearer and louder than could be obtained before with the same whistle fitted in the usual way.

We are informed that the whistle is capable of producing the number of 164 separate blasts per minute for use in the Morse code.

CYLINDER LOSSES AND THE ADIABATIC EXPANSION OF STEAM WITH AND WITHOUT SUPERHEAT.*

To generate steam economically is rightly looked upon as one of the most important duties of engineering, for much depends upon it, but it is of equal importance that the steam when produced should be used to the best advantage, and it is in order to endeavour to to locate losses and suggest remedies that this paper has been written. To use steam as economically as it is generated is perhaps even more difficult, and that it is necessary to investigate the details of losses in the using quite as carefully as the details of losses are generally gone into and which are inseparable from its production, will appear evident from this fact, that many engines at the present day turn less than 50 per cent. of the heat available into work. It is common knowledge that boilers give efficiencies of 80 per cent., and engines use 16·5 lbs. of steam per kw. hour and even less; therefore, if the heat value of fuel is taken at only 12,500 B.Th.U. per lb., such plant, using these figures, should produce a unit of electricity for 1·6 lb. of fuel; if further investigation is made it will be found that from 100 to 500 per cent. more steam is actually produced than such figures indicate, and 2·75 to 4 lbs. of fuel per kw. hour is considered excellent modern practice. Allowances must be made for auxiliaries, stand by and other losses which in moderation are legitimate charges on the fuel bill, but from these practical figures it may be seen there is ample room for better economy to be realized.

In order to eliminate the more subtle sources of loss in the conversion of heat into work by means of the steam engine, it is essential to have a thorough understanding regarding the theoretical and practical possibilities of the duty which can be obtained from steam, and nowadays previous ideas adapted to new systems and applications of the use of steam demand revised methods for dealing with problems to enable results to be correctly interpreted. It is the nature of some losses to explain and proclaim themselves, and such will readily occur to us, but there are others which can only be adequately dealt with by systematically studying and analysing the conditions under which the conversion into work takes place, and much useful information is to be obtained by so doing. Generally the majority of steam plants on land require to be able to give a considerable overload, and should, therefore, be designed to give the best efficiency at their average rather than at their maximum load; unfortunately, capacity has oftentimes to be sacrificed to efficiency. On the other hand, the marine engine is, for long periods at a time, working under its best conditions, being invariably designed to give the highest economy at its maximum output. Probably this may have something to do with the fact that little superheating is done on board ships, but more will be said later regarding this.

The chief causes affecting the efficiency of the steam engine may be broadly stated as:—

(1) The Thermal Losses represented by:—Condensation (not liquefaction), Radiation, Imperfect expansion.

(2) The Mechanical Losses represented by:—Internal and external leakage, Imperfect lubrication, Friction of moving parts.

(3) Thermal Losses due to mechanical defects, such as:—Wiredrawing, Operation of valve gear, Clearance.

It has been truly said that the moment we begin to define we begin to fight; nevertheless, it is essential to have a clear conception of the most important, and, until recently, the most neglected of all the efficiencies applied to our steam plants.

A letter or symbol is badly wanted to denote this efficiency, and many such symbols which are in common use will, no doubt, occur to you, such as Young's Modulus of Elasticity known as E and the well-known π. It would have been a graceful compliment to the name of Rankine had it been known by the Greek capital letter P (rho), and which would also immediately suggest should it be read as the English letter, the percentage of the possible work which may be realized.

Criticism has been defined as the adventures of a soul among masterpieces, and to this the writer takes no exception, but for all that it is sometimes necessary to look carefully at the masterpieces, and Carnot's classical theorem applied to steam engines is one of them. This important theorem indicates the most favourable conditions, making for economy, and shortly stated is as follows: The amount of work performed by a reversible or perfect heat engine depends only on the constant temperature at which heat is received and at which it is rejected, or the absolute temperatures between which it is worked, and is independent of the nature of the intermediary agent or $T_1 - T_2/T_1$ expresses the second law of thermo-dynamics, and one of the best definitions is the following: If all heat absorbed be at one temperature, and that rejected at a lower temperature, then the heat transformed into work will be in the same ratio to the entire heat absorbed as the difference between the absolute temperature of the source and refrigerator is to the absolute temperature of the source. In other words, the second law is an expression for the efficiency of the perfect elementary heat engine. No engine builder at the present day applies this formula in order to ascertain the probable steam consumption of any engine he builds and guarantees, and the practical engineer is somewhat at a loss regarding the result obtained when he applies it to any engine of his acquaintance. It is admitted that the steam engine can never, comparatively speaking, even remotely approach this standard, and, indeed, with more accurate knowledge on the subject of steam, it is quite possible that such a formula when applied to the future steam engine, may be found directly at variance with results, as has already been pointed out.

After all efficiency has been described as the ratio of what it should be: to what it is, and this is the Rankine standard. We need not quarrel with any other. Inlet and outlet steam conditions are easily ascertained, and what we require to know is—if one engine were mechanically perfect, what would its steam consumption be under the conditions given to us? Knowing this, it becomes an easy matter to say whether we are obtaining the best possible efficiency, or if not, what steps require to be taken to improve matters.

Zeuner, in his classical study on Thermo-Dynamics, states that the conditions to be fulfilled by the perfect engine are as follows:—(1) That no clearance space is present in the cylinder. (2) That the steam pressure in the cylinder is equal to the boiler pressure. (3) That the steam pressure on the exhaust side is identical with the condenser pressure, or, in the case of non-condensing engines, is identical with the external atmospheric pressure. (4) That no heat exchange occurs between the steam and the cylinder walls while the cycle is being described within the cylinder. (5) That expansion takes place adiabatically and, moreover, completely, *i.e.*, that the pressure of the steam during expansion sinks from the boiler pressure down to the condenser or atmospheric pressure as the case may be. (6) That the valve gear is so constituted that during steam admission the entrance port is completely open, and during the exhaust stroke the exhaust space is connected with the condenser or open air by a completely open discharge conduit. Precisely what takes place when the heat of steam is converted into work is very obscure, but probably there is great variation in the internal molecular tension in the substance itself. Under adiabatic expansion steam doing work draws upon its heat store, and in so doing liquefies an amount due to the work performed, but in practice a great deal more than is theoretically necessary is liquefied, and this suggests that in addition to the amount liquefied in performing such work a further draw is made upon the steam's heat store to enable

* Abstract from a paper by Mr. J. Clark (Member) read before the Institute of Marine Engineers, January 17th, 1910

the other portion to do its work, this further amount depending upon the precise conditions under which the steam is converting its heat into work in the first instance. More theories have been woven round the subject of what is generally the chief loss in the cylinder—namely, *initial condensation*—than all the other losses put together. It is well to distinguish between condensation and liquefaction, the first, as commonly understood, being the conversion of steam into water, due to contact with surfaces colder than itself; the second being due to the conversion of heat into work during adiabatic expansion. It is almost hopeless to arrive at a correct theory as to the cause of so much more than theoretical liquefaction or condensation until we know in what manner steam parts with its heat in doing work. It may be said that we are quite ignorant of the laws which govern this conversion; the difficulties in the way of acquiring sound knowledge are great and consequently any available data are based on the surfaces in contact with the steam to the point of cut off, the temperature ranges, the number of revolutions per minute or the density of the admission steam should not be used to dogmatize; but perhaps with more exact knowledge we may also find that the other losses want a deal of explaining too.

Condensation due to the difference within the cylinder between initial and exhaust temperatures certainly does take place as well as from radiation effects, but it is quite impossible on the evidence we have to accept this as a satisfactory explanation for the whole of the loss. It is well known that the reciprocating steam engine cannot usefully use a higher vacuum than about 80 per cent. of perfect vacuum owing to the very large volumetric increase of the medium at higher vacuum, and no doubt had the vacuum been about 24 or 25 inches during the test of this triple set, its thermo-dynamic efficiency would have been as good as the single-cylinder engine. This feature is undoubtedly a serious defect in the reciprocating type of plant; in other words, the available heat units for work after about 25 inches of vacuum cannot be usefully employed, and the consequent loss is great, as shown further on. This, of course, is only one instance; and if some of the numerous published results to be found in the pages of our highly interesting technical journals are carefully studied, it will be found that the thermo-dynamic efficiency of a single cylinder engine is quite as good as any obtained from any other type, assuming both types to be working under their most favourable loads. In a multiple-cylinder engine the thermo-dynamic efficiencies should not only be calculated for the engine as a whole, but each cylinder should be dealt with separately; by so doing, any mechanical defect causing a more pronounced thermal loss in any of the cylinders may be the more easily ascertained and put right. If separated from the performance of work it is questionable if the metal surface shave prominently to do with initial condensation; possibly we might learn whether initial condensation is caused by some internal change in the steam as suggested, or whether it is due entirely to the action of the walls, if it could be arranged by some outside means to experiment by driving the engine with the steam on and noting the effect on the steam admitted to the cylinder; such an experiment does not sound so impossible as it may seem at first, because the back pressure could be maintained slightly higher than the mean pressure. The result would be that with a definite cut off the indicator card taken would have a very large loop in the expansion curve, but this is of small importance, as the information wanted relates to what takes place before the valve closes. Possibly such an experiment may have already been carried out, but of this the writer has no knowledge. The idea, perhaps, might be considered by some of our well-known professors interested in this matter who have suitable plant and appliances at their disposal for conducting such an experiment.

Rankine states that the conduction of heat to and from the metal of the cylinder or to and from water contained in the cylinder has the effect of lowering the pressure at the beginning and raising it at the end of the stroke, the lowering effect being on the whole greater than the raising effect, and goes on to say that in some experiments the quantity of steam wasted through alternate liquefaction and evaporation in the cylinder has been found to be greater than the quantity which performed the work. This unfortunately is the experience of every user. Although there are other conditions which affect initial condensation such as size, revolutions per minute, the action of lubricants, quickness in operating the valves, etc., these would seem only to affect this loss in degree and are what may be called contributory causes only; in no case could alteration to any or all of these put matters right, because in all classes of engines initial condensation is to be found, and the limit of thermo-dynamic efficiency may be taken as 80 per cent. Steam jacketing under certain conditions has given good and under other conditions contradictory results; but it has been aptly said one thing it does do and that is, that it adds greatly to the selling value of steam plant so constructed. In order, therefore, to reduce cylinder losses it is essential: 1st. That there should be no throttling of the flow of steam into and out of the cylinder. 2nd. That clearance spaces be reduced to the absolute minimum. 3rd. That the design and arrangement of the cylinder must permit of thorough and efficient natural drainage. 4th. That superheated steam should be employed 5th. That the engine must be a first-class mechanical job in every respect.

Progress, especially in marine engineering, would undoubtedly have been practically arrested without the steam turbine, and we owe much to the genius of its great inventor, and not the least is the fact that the work to be obtained from steam under adiabatic expansion has been ably treated and made more understandable by many minds and elevated from its rut of academic theory into one of the practical sciences.

The two chief types of those in use to-day are the reaction and the impulse, and it would seem generally that there is little to choose between them in the matter of thermo-dynamic efficiency; one type may suit certain conditions better than the other, though perhaps the modern Parsons reaction type is slightly better in efficiency than others. The turbine exemplifies the well-known fact that considerable pressure can be taken out of steam without incurring any marked loss in its capacity for performing work. In the impulse turbine the expansion takes place in the nozzle, and if this is of perfect form the available heat units are all converted into kinetic energy represented by velocity which is equal to

$$\sqrt{\text{B.Th.U.} \times 778 \times 2g}\ \text{W},$$

and the foot lbs. of useful work may be obtained from the usual formula $WV^2/2g$, whereas in the reaction type expansion takes place both in the moving and fixed blading.

The turbine has not only popularized but enforced adiabatic computations, and the entropy or $\phi\ \theta$ diagram is to the writer's mind not only the easiest but the most explicit of all methods for ascertaining the work and condition of steam. The essential conditions which require to be known are the quality of the initial steam and its inlet and outlet pressures and temperatures. There is no doubt but that some of the high thermo-dynamic efficiencies claimed for the turbine are open to question, and as the instances when these claims were put forward, involved the use of superheated steam it would appear as if the turbine had the benefit of any doubt as to the correct specific heat under the observed conditions.

The question has been asked whether the high degree of vacuum most turbines can employ should be looked upon as a special merit of theirs because they are able to use it, or should it be considered a defect because they depend on a high vacuum for economy. So far as thermo-dynamic efficiency is concerned (incidentally it may be remarked one seldom hears of the Carnot efficiency in connection with turbines) it does not seem to matter; however there need be little doubt in placing the turbine in the first category.

The increased power to be obtained from reciprocating engines due to condensing may be put at about 25 per cent., whereas available heat units to 26 inches vacuum are practically doubled, or the reciprocating engine virtually throws away 75 per cent.; on the other hand the turbine can utilize practically the whole of the heat units available without any decrease in its thermo-dynamic efficiency as the following figures show, which were also ascertained with the same turbine the output being approximately constant at 275 kw or 55 per cent. of its rating.

The correct vacuum which should be carried on turbines is a matter of very great importance, and depends not only upon the cost of the fuel used but also upon the bank rate of interest. Low steam consumptions are to be obtained by

increasing the vacuum, but only by laying out more capital and expending more power for the pumping plant, and it is quite possible to overdo the vacuum and have a poor return financially. The condition of the exhaust steam from turbines will be found much drier than the exhaust from the reciprocating engine working under similar conditions, and when high degrees of initial superheat are used probably the exhaust will also contain a considerable amount of superheat. If the heat units in a lb. of steam under actual exhaust conditions are deducted from the heat units initially supplied to obtain the heat units available for work under such conditions assuming adiabatic expansion, the thermo-dynamic efficiency obtained will in many instances be about 100 per cent., which naturally is absurd, and obviously if heat produces mechanical work, and this is converted back again into heat by friction resulting in adding superheat to the exhaust, the turbine should get the credit of producing mechanical energy with a much higher efficiency than 100 per cent., because the steam not only performed its allotted work in the first instance, but in addition heats itself by means of its mechanical energy; such a theory is difficult to accept against the more natural one of believing that any quality of dryness over that due to adiabatic expansion is simply due to a certain proportion of steam expanding to a lower pressure without performing work and consequently surcharging the exhaust with heat; it would appear, therefore, in ascertaining the thermo-dynamic efficiency of a turbine, to be correct to ignore altogether the quality of the steam at the lower temperature and simply take the pressure and its corresponding temperature of saturated steam.

The conversion of steam into practically a perfect gas by surcharging it with heat or superheating it has been found to considerably reduce the consumption per H.P. hour as well as to lessen the boiler output for a given power, probably because in this state it is in a more stable condition than when saturated, and therefore does not part with its heat so readily. In support of this statement it has been found experimentally that if superheated steam is employed for evaporating purposes it not only takes about 30 per cent. longer time than saturated steam to evaporate the same amount of water, but also requires a greater amount of steam to do it. The principal economy gained by superheating has been attributed to the fact that it licks up the moisture on the metal surfaces and so prevents the condensation of the incoming steam. No doubt it will do so; but probably it is more correct to say that its economy is because, being more or less of the nature of a gas, it does not so easily part with its heat, and therefore does not deposit moisture on the walls, and also in performing work the internal changes going on are very different from those which take place with saturated steam; superheated steam having the peculiar characteristic that it can lose heat without forming water until its temperature corresponds with the temperature due to saturation, when of course a further drop will produce water.

Superheating undoubtedly has much more power to influence a noticeable reduction in steam consumption when the engine is working under very light loads with early cut off, or—if it is not an economical one in the first instance, than it has under full load conditions and first-class plant. Marine engines run chiefly under their most favourable conditions, and consequently, comparatively speaking, small gains in economy are only possible in practice, whilst a large outlay in capital expenditure is necessary, as well as the difficulty of satisfactorily applying the plant.

Against the saving by superheat has to be set interest and depreciation:—(1) On the capital outlay for superheating plant. (2) Certain extra steam losses incidental to the use of superheated steam. (3) Extra lubricating oil and its consequent separation from the water of condensation. (4) Probably heavier plant repairs due to unequal expansion and inefficient lubrication causing excessive wear. (5) Repairs to superheater and its furniture which, although probably small, have to be paid for. (6) The plant must be carefully attended to, as a high superheat, even for a short period, may be attended with serious or even disastrous consequences to the engine, if not to the superheater itself. The most critical time is when, after hard firing, it is necessary to reduce the quantity of steam taken, or the rate of flow suddenly; at such periods and under such conditions, the degree of superheat may in a short time become excessive unless there are means arranged to meet such a contingency. (7) More joints have to be made and kept tight. Still, with all these disadvantages, superheating properly applied, installed and attended to has been proved to give a return worth seeking after, in many cases, although somewhat less than usually claimed; and, indeed, without superheating the best results cannot be realized. Generally the points in favour of superheating are:—(1) Less coal and water used, consequently the boiler is more easily fired. (2) Condensation in steam pipes overcome and steam trap losses eliminated. (3) Heavy initial cylinder losses materially reduced, resulting in increased thermo-dynamic efficiency, whether these are due to condensation or leakage or both combined. (4) Superheating increases the B.Th.Units available for work, without adding to the pressure. It may be taken as an axiom that the more wasteful in steam an installation is, including the engine, when using saturated steam, the more the saving will be with superheated steam; it is therefore easy to see that, having a good engine and plant to begin with, high percentage savings are the more difficult of attainment.

The no-load losses should always be ascertained by every engineer in charge of steam plant, be it reciprocating or turbine machinery, because by its aid it is always possible to find out whether a reduction made in steam consumption is due to re-organizing steam pipes, an improved method of working or setting valves, or in the case of an increased consumption, whether it is due to wear and neglect or some serious disarrangement which may not immediately affect the mechanical working of the plant.

It is questionable if superheating as applied to modern plant would have made the headway it undoubtedly has if the saving due to its use had been entirely confined to the suppression of the missing quantity inside the cylinder. On land installations a considerable percentage of this saving is obtained in the steam distribution system, which as a rule is much more complicated than found in marine work.

JUBILEE MEETINGS.—INTERNATIONAL CONGRESS.—H.R.H. the Prince of Wales has graciously consented to accept the Honorary Presidency of the Congress in Naval Architecture and Marine Engineering, which will be held in London on Tuesday, July 5th, and the following days.

THE ELGAR SCHOLARSHIP IN NAVAL ARCHITECTURE.—The Council of the Institution of Naval Architects are about to offer for competition this scholarship, which is of the annual value of £50, and is tenable for three years. The candidates are to be students of the Institution, and not less than eighteen, or more than twenty-one, years of age, on March March 1, 1910, and must at that date have been continuously employed for two years upon naval architecture or marine engineering. Full particulars can be obtained from the Secretary of the Institution of Naval Architects.

THE Editor of our contemporary, "The Engineering Review," recently visited Manchester to preside at a meeting of the working executive of the Engineering and Machinery Exhibition which will be held in the City Exhibition Hall, Manchester, during the forthcoming autumn. A committee of twenty-seven, including representatives of some of the leading engineering firms in the country, are assisting the promoters towards making this demonstration of machinery the finest that has ever been held in Lancashire. Though the success of the exhibition is well assured, the honorary officials are working to make the occasion a memorable one and a record so far as the North of England is concerned. The deputation of engineers appointed to visit the City Exhibition Hall were surprised that such a commodious building should be found in the heart of the city. The appointments, such as fittings for water, electric power, gas, etc., were commented upon most favourably, and the claim that this hall is the finest equipped exhibition hall in the kingdom is by no means an idle boast. The educational side of the exhibition is also receiving the attention of the management, who anticipate that such features as a series of lectures, competitions for workmen, students, etc., will add to the attractiveness of the show.

FRACTURES IN ECCENTRIC STRAPS AND HOW TO REPAIR THEM.

PROBABLY one of the most liable parts of a marine type engine to fracture is the eccentric strap and rod, more particularly when sudden changes of load or reversals of direction are to be expected. This is perhaps not very much to be wondered at, having regard to the very wide area of surface which is usually to be found on the eccentric sheath, and the restricted space into which the eccentric is put, leaving the question of efficient oiling in some cases rather too much in the hands of chance. It may, therefore, be interesting to point out one or two typical fractures on eccentrics in order to show how they may be still used in active work for, at any rate, a short time, until a permanent repair can be effected.

One of the most common forms of fracture is shown in Fig. 1, where the top half of the eccentric strap breaks across. This may occur, either owing to friction on the sheath or too sudden a wrench or twist, due possibly to the valve working in conjunction with the eccentric seizing on the face. The sketch also illustrates one of the best methods of repair for such a case, which is to take a piece of strip mild steel and make it into a patch, following the shape of the outside of the eccentric strap and of the same width, and then to fasten the patch securely to the metal of the strap by means of tap bolts. Where it is suspected that a breakdown of this description is caused by seizing on the valve face, it is a very useful thing to drill some small holes $\frac{3}{8}$-in. diameter through the working faces of the valve, and to cut oil ways. In this way the steam itself will be allowed to ease the pressure of the valve on its face.

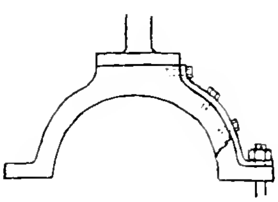


Fig. 1.

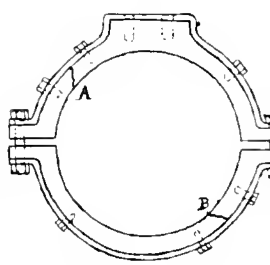


Fig 2.

Another method of repair, which is really an extension of the former one, may be used where a double fracture takes place, as shown at A and B in the eccentric strap, Fig. 2, due to a sudden overheating of the sheath, which will expand and burst the strap at the two points shown. Such an occurrence is very probable when, in adjusting the strap by means of liners between the two halves, insufficient room is allowed between the strap itself and its sheath. Where there are no spare straps available the repair can be effected by cutting strips of $\frac{1}{2}$-in. plate to go round the top and bottom halves, as shown in the sketch. The pieces are then put together and $\frac{3}{4}$ in. holes drilled through the pieces of plate and into the strap itself. The holes are then tapped and the bolts screwed tightly in. In such a repair it must be observed that in order to keep the slide valve set fair an adjustment should be made at the foot of the eccentric rod, in order to avoid increasing the length of the rod by the thickness of the strap. In many cases it will be found that liners are placed under the foot of the eccentric rod as the strap and link motion wear down, in order to keep the slide valve in position, and where such liners are inserted they should be lifted out to the thickness of the steel strip, that is to say, $\frac{1}{2}$ in. If a repair of this description is carefully done there is no reason why a strap mended in this way should not run indefinitely just as well as when it left the shops.

Yet another instance of fracture may be taken from a case which occurred in connection with a winch eccentric strap and rod which broke, as shown in Fig. 3. These fractures occurred owing to the fact that the bottom bolt securing the halves of the eccentric together broke and fell out. It did not then take long for the top bolt to work loose, and the half of the eccentric strap, which was secured to the eccentric rod, twisted round and caught other moving parts of the main driving shaft of the winch, causing the fractures as shown. The fracture in the strap itself was repaired by means of $\frac{1}{2}$-in. plate secured to the outer surface of the strip before described, a variation being introduced by using instead of tap bolts some $\frac{1}{2}$-in. countersunk headed bolts, the heads being placed on the inside, slightly under the curved inner surface of the strap. The fracture in the rod was bound together by means of two pieces of $\frac{1}{2}$-in. plate put one on each side of the rod, and secured by means of $\frac{1}{2}$-in. bolts running right through the two pieces of metal as shown. It might have been possible to strengthen the repair by putting small

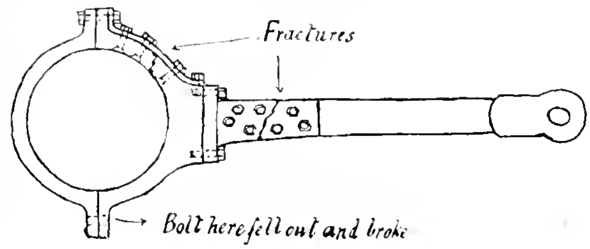


Fig 3.

plates on the sides of the eccentric strap, only that the head-way and stern sheaths were rather too close to each other to admit of this. The repair, however, answered perfectly satisfactorily.

Even when the eccentric strap does not actually break it sometimes occurs that owing to continued service it becomes very worn and thin, and it is sometimes inconvenient to obtain a new one. When this is the case a useful thing to do is to run a liner of white metal round them. In one such instance, illustrated in Fig. 4, the sheath was a flat one with a flange $\frac{1}{4}$ in. wider than the sheath. The valve had been lined up to such an extent under the foot of the rod that there was hardly any room for a full nut on the studs. The work was commenced by drilling, tapping and inserting a series of $\frac{3}{4}$-in. brass studs inside the strap about $1\frac{1}{4}$ in. long and pointing towards the centre. These were bedded on to the sheath roughly so that they were all touching the sheath. The next step was to bend a piece of $\frac{1}{8}$-in. iron to the half of the sheath and turned up at the end so that it could be bolted to the strap. This formed the retaining surface on the outside end of the stud, as will be seen from the sketch. The strap was then warmed up and laid on to

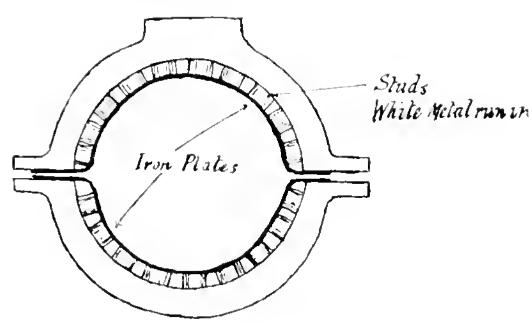


Fig 4

a flat plate, and the space between the original strap and the iron plate, which was partially filled up by means of the studs, was then run up with white metal. After this was cooled the plate was taken off and the strap was bedded on to the sheath with very little difficulty, inasmuch as it was a fairly good fit at the first trial. This somewhat extraordinary repair proved to be very sound in running, as the white metal had the additional advantage of being something of a lubricant.

The above examples indicate pretty clearly the way in which apparently broken or worn out plant can be renovated so as to serve a further useful period, and they therefore may be of interest to engineers to whom economy in capital cost of plant is a consideration.

MARINE BOILER EXPLOSIONS.

From the Board of Trade Reports.

REPORT No. 1884 has reference to the explosion from a boiler on board the steam drifter *Promote*. The explosion occurred on the 15th September last, when the vessel was about 11 miles east by south from Peterhead bound inwards from the fishing grounds. No person was injured by the explosion. About the beginning of last year, several stays were renewed in the combusiton chamber. On the 11th September last some of the seams at the back end of the furnace were caulked. There was a bolted patch about 8 inches in diameter fitted over the end of a stay in the back of the combustion chamber near the bottom, and two other similar patches on the bottom of the combustion chamber. There was also a bolted patch about 10 inches by 12 inches on the back end of the boiler near the bottom. A hole about ¾ inch in diameter was formed at the corner of the flange at the bottom of the combustion chamber, near one of the patches previously described, through which the contents of the boiler escaped rapidly into the engine room, the pressure at the time being about 110 lbs. per square inch. The explosion was due to corrosion on the fire side of the plate, caused by leakage from the landing edge of a patch in close proximity. In consequence of this the plate became unable to withstand the ordinary working pressure. The observations of the Engineer Surveyor-in-Chief are as follows:—In this case, the boiler does not appear to have received the attention which is necessary if such vessels are to be worked with safety, and it is fortunate that the failure of the part affected by corrosion was not attended with serious consequences.

Report No. 1885 has reference to the explosion from a main steam pipe on board the s.s. *Inveric*. The explosion occurred on the 9th November, 1907, when the vessel was about 130 miles east of Monte Video. No person was injured by the explosion. The pipe was made from a solid drawn copper tube, 5¼ inches in internal diameter, ¼ inch in thickness, and about 6 feet 3 inches in length. The ends of the pipe were fitted with brass flanges, brazed on in the usual manner. The pipe cracked, circumferentially, for a length of 5 inches, at the neck of the flange, at the upper forward side, next the stop valve on the starboard boiler, and steam escaped into the boiler room. The steam pressure at the time was 180 lbs. per square inch. The explosion was due to the material being unable to withstand the stresses set up by the expansion and contraction of the pipe, and the movement of the machinery, under ordinary working conditions. The observations of the Engineer Surveyor-in-Chief are as follows:—The failure of the steam pipe appears to have occurred under ordinary working conditions while the weather was fine. It is probable that the pipe became hardened locally, under working conditions, where fracture occurred. It is desirable that copper steam pipes should periodically be removed and carefully annealed, so as to bring the material back to its original softness and ductility.

Report No. 1887 has reference to the explosion from a boiler on board the s.s. *Kura*. The explosion occurred on the 3rd August, 1909, when the vessel was in the Atlantic Ocean, on a passage from Manchester to Batoum. A fireman was badly scalded about the body and died nine days after in the hospital at Malta. The boiler which is made of steel with the exception of the smoke tubes, which are of iron, is of the cylindrical, single-ended, multitubular, marine type. A rivet, which had been fitted into a crack, was displaced by the pressure in the boiler, thus suddenly liberating a quantity of water and steam, which was forced from the boiler into the stokehold. The explosion was due to the fireman striking the rivet head with the slice, when cleaning the fire, the rivet being a loose fit in the rivet hole. The observations of the Engineer Surveyor-in-Chief are as follows:—Attention has been previously drawn to the danger which may arise from repairing cracks in furnaces merely by studs or rivets, and it is to be hoped that this further instance of the unreliability of the practice will serve to deter those responsible for the safe condition of boilers from adopting such means of repair except as a temporary expedient.

GERMANY'S FIRST DREADNOUGHT, "NASSAU."

OF the four battleships of the *Nassau* class, the *Westfalen* and *Nassau* are now ready for commissioning, and the *Posen* and *Rheinland* completing for sea. Built under the greatest secrecy, these first German "Dreadnoughts" have for the past three years been thorns in the flesh of the naval expert. Unable to obtain authentic information concerning them he has perforce had to fall back upon a fertile imagination, when endeavouring to prove that the advent of these vessels would render the British ships obsolete. Armaments ranging from sixteen 11" down to ten 11" guns were attributed to them, so disposed that 80 or 100% of the total gun-fire had broadside bearing. Consequently, the *Nassau* was regarded as a finer fighting ship than the *Dreadnought*, and upon this assumption much valuable paper and ink was expended during the recent "Navy Scare."

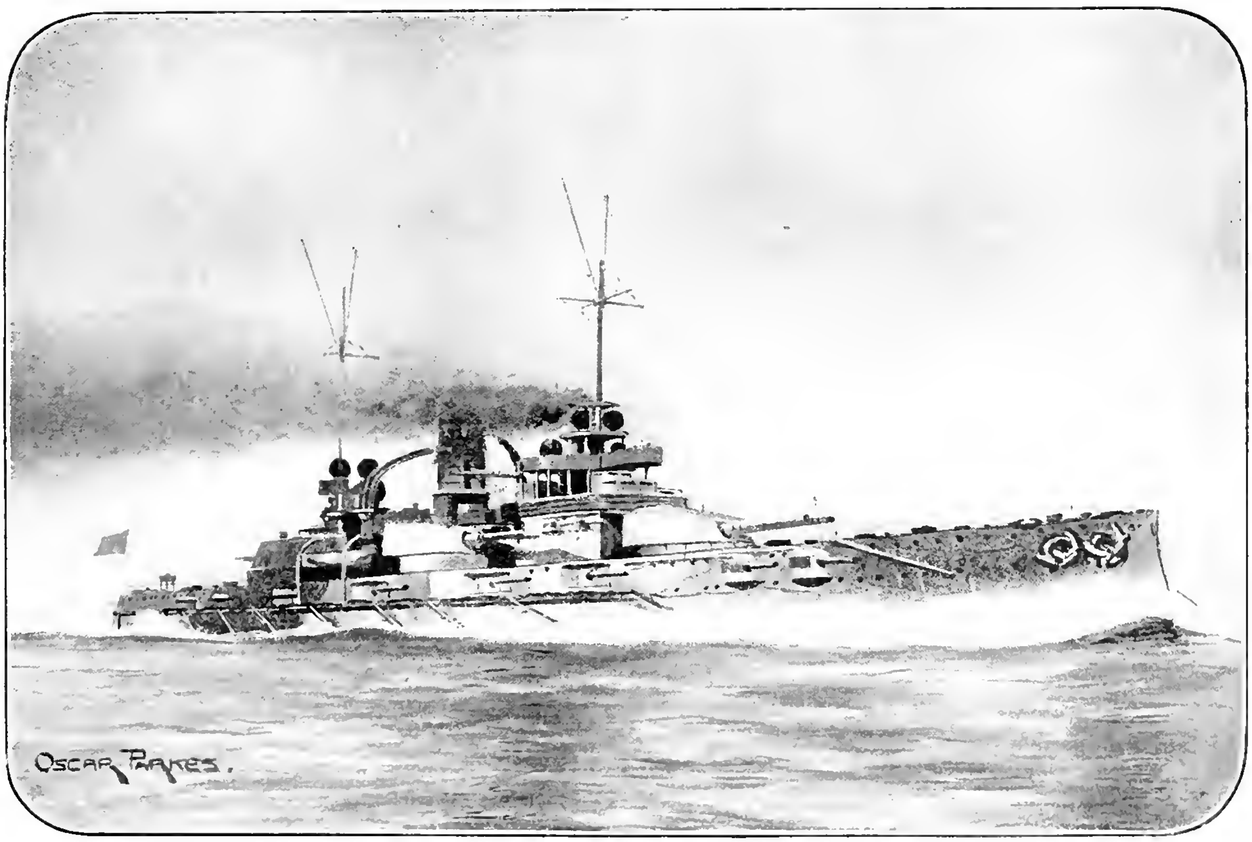
The illustration and plan herewith show the actual appearance of the ship, from which the real battle worth can be gauged. Instead of having four turrets in the centre-line in pairs fore and aft, arranged so that the inner guns fired over the bow and stern pieces (like the Brazilian *Minas Geraes*) with a couple of two-gun turrets *en echelon* amidships, the arrangement is the most commonplace one that could be conceived. Why, after the success of the *Dreadnought* disposition for ten guns, and the infinitely better all-round fire that might have been attained had the guns been placed after the *Minas Geraes* style, the German designers should have adopted the very design which gives the most limited all-round bearing for twelve guns, is difficult to imagine. Instead of some novel design, as was universally expected, the previous *Deutschland* class has been followed in general outline, and twin 11" gun turrets placed at the corners of the superstructure vice 6·7" guns. The main deck 5·9" battery were more or less of an afterthought. As originally designed—and even when launched—no accommodation for these guns was arranged for, and it is thought that they were afterwards added when the great growth in the size of torpedo-craft postulated a defensive battery of larger pieces than the 3·4" or 4·1" guns. Certainly the inclusion of both 5·9" and 3·4" calibres in the secondary battery must be viewed in the nature of a compromise between the all-big-gun and small-secondary-gun school, and the increasing party who favour the retention of the medium calibre for torpedo defence and perhaps battleship work. Mounted as they are, the 5·9" fire-guns will suffer in a sea-way, but for all that their presence certainly augments the *Nassau's* anti-torpedo battery very greatly.

As regards arcs of fire, there would seem to be about 120° for the amidships and 280° for the fore and after guns, but exact figures are lacking. Out of the twelve guns only six can be fired axially and eight on either beam, or 50% and 66⅔% of the total big-gun armaments, as against the 60% and 80% respectively of the *Dreadnought*. The 5·9" main deck guns are mounted in deep recesses, while the hull is so shaped as to allow the maximum all-round training. The small q.f. pieces are carried in small sponsons at the bow and stern and in the superstructure. The

after four are right up against the stern-post, the peculiar cutting-away of the main deck to allow for a dead-astern fire being copied from the Russian *Rurik* and *Slava* classes.

As regards protection, only general details of the class are known. Amidships the belt is 11″ thick, tapering to 6″ at the bow and stern. The conning tower forward is of 12″ thickness of armour, while the big-gun turrets are made of 11″ steel. A main deck strake protects the 5·9″ battery, and this is reported to be 6″.

The dimensions are:—Length 451′, beam 89′, and draught $26\frac{3}{4}$′, giving a displacement of 18,204 tons. With 20,000 I.H.P. (reciprocating engines) her designed speed was 19·5 knots, but this has been greatly exceeded on trial, when 20·5 knots was attained, from which it may be seen that the official anticipated speed of "over 19 knots" has been more than justified. The minimum coal supply is 950 and maximum 2,700 tons, which is superior to our



The German Dreadnought *Nassau*

Dreadnought by 50 tons in the first case, and equal when the bunkers are full. Her cost was £1,840,000, or about £100,000 more than the *St. Vincent*, which increase can easily be accounted for by the extra gun-mountings and guns, the *Nassau's* armament being twelve 11″, twelve 5·9″, or sixteen 2·4″, against ten 12″, and twenty 4″ guns.

As previously stated, there is nothing particularly striking in the appearance of the ship, except that there are one or two little novelties in the superstructure. In the first place, the fore-funnel is right up against the mast, and connected to it by the searchlight platforms, which are in two tiers round both masts. The w.t. gaffs at the strike are said to be merely experimental and temporary. All boats are nested amidships, and manipulated by the big cranes. The torpedo nets round the main deck are a big innovation, these new ships being the first to be so fitted.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent).

Portsmouth Dockyard.

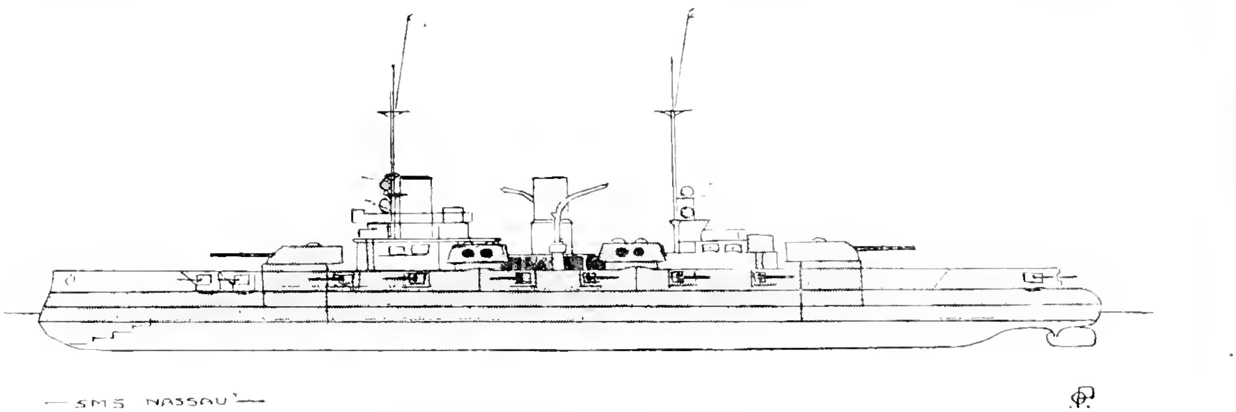
THERE is every prospect of Portsmouth being as busy during this year as last. The details of the new estimates have received official approval, and it is known what work has been allotted to us, but everything is now so strictly confidential that nothing relating to the new financial programme has transpired beyond the fact that the present 10,500 employees are to be retained, and there are to be no reductions. This is regarded as most satisfactory. It is understood that immediately the battleship *Orion* has been launched preparations are to be made for the commencement of a new vessel, but what she will be like is, of course, a secret. With regard to the progress of the *Orion* nothing is known outside official circles, a new *régime* having been introduced. An Admiralty order has been promulgated under which newspaper correspondents and photographers

are not only rigidly excluded from the vicinity of the building ship, but they are not allowed that freedom of access to other parts of the yard which they have hitherto enjoyed. It is, however, understood that very good progress has been made with the vessel. As in the case of the battleship *Neptune*, the bulkheads are being got into position before the sides are built up. A large quantity of material has been prepared in the workshops alongside the ship, so that there is not likely to be any delay in her construction. The battleship *St. Vincent* is shortly to be commissioned by Captain Nicholson for service in the First Division of the Home Fleet. Both the Royal yachts, the *Alexandra* and the *Victoria and Albert*, are being thoroughly overhauled and refitted, and they are to be ready for service by the middle of February. The *Victoria and Albert* will, it is understood, go up the Mediterranean in March, as it is said that the King and Queen contemplate a sea trip in the spring. The cruiser *Rainbow* which has been laying at the Motherbank for some time past, is to be refitted at a cost of about £14,000, after which she will be transferred to the Canadian Government for use as a training ship. The *Rainbow*, which was built at Jarrow in 1891, has a displacement of 3,600 tons and a speed of 10¾ knots. The old cruiser *Indefatigable* has arrived from the West Indies and has been paid off and recommissioned. She has now been renamed the *Melpomene*. The last vessel of that name was a small cruiser, and she was struck off the effective list seven years ago.

Collingwood. The official trials of the *Collingwood* began on January 3rd. Providing they are all satisfactory, which there is every reason to anticipate will be the case, the ship will be ready for service by March 31st. Captain Barnardiston is commanding the vessel during her trials. By the end of March, too, the refit of the cruiser *Pelorus* is to be completed. The *Kennet* of the Second Destroyer Flotilla, has come in for a refit, as has also the sloop *Espiegle*. The latter vessel, which has been relieved by the cruiser *Pomone* as tender to the Royal Naval College at Dartmouth, is to have £15,000 expended on her, after which she is to go to the East Indies Station. The work of reconstructing the damaged fore end of Torpedo-boat No. 105 is making rapid progress, the decision not to replace the bow torpedo tube having facilitated the work very much. Our admiral-superintendent has somewhat unexpectedly been promoted to vice-admiral, but he will not leave until his two years are up, which will be at the end of March. It is a coincidence that Vice-Admiral Cross's three predecessors were also promoted while here.

Chatham Dockyard.

According to Alderman Jenkins, M.P. a new vessel is to be built here, but he did not mention in his speech the class of vessel. There is an impression that it will be a cruiser, and if a large vessel is to be built this will no doubt be correct. A remarkable statement was recently made in a provincial newspaper by its London correspondent to the



Plan of the German Dreadnought *Nassau* (page 269)

Devonport Dockyard.

Admiral of the Fleet Sir Arthur Wilson, who by now has succeeded Lord Fisher as First Lord of the Admiralty, paid us a visit early in the month. He remained two days, and his inspection was necessarily of a somewhat hurried character. Sir Arthur, however, was able to see the new cruiser *Lion*, which is in course of construction, and he also inspected the old No. 2 slip, which is being converted into a dock for torpedo craft. He afterwards inspected the new cruiser *Indefatigable*, and visited several establishments, including the *Indus*, which is the mechanicians' training establishment, and the Royal Naval Engineering College at Keyham. With regard to that institution, it has been announced that the College is to be closed when the twenty-one cadets there complete their course of training in July. It is anticipated that for about two years it will be empty, as under the new scheme the officers intended for the engineering branch will not be ready to commence their special training until 1912. Work in connection with the construction of the *Lion* is very satisfactory. The main keel and bottom frames and brackets are in position, the fore and aft bulkheads in the central section are fixed, and the frames forming the over-hanging stern section are well advanced. The additional masts for lifting the material for the bow section, rendered necessary by the lengthening of the ship, have also been placed in position. With regard to the cruiser *Indefatigable*, that vessel is making excellent progress. The bow and stern armour is all in place, as is also about half of the side armour. The rudder castings and main shafting are being got into position. The dimensions of the rudder and shafting, it is interesting to note, are twenty-five per cent. over those of the battleship

effect that the Admiralty proposed to acquire a frontage east of Chatham and Gillingham of about 500 acres, on the Medway, for conversion into docks. That may or may not be the case, but the writer went on to say that probably at no distant date tenders would be invited "for the construction of extensive works which will bring Chatham into direct contact with Sheerness Dockyard." Seeing that Sheerness is ten miles from Chatham, the works to connect the two would indeed be extensive. The cruiser *Minotaur*, having completed her refit, has left for the China Station to relieve the *King Alfred* as flagship. Captain Cayley, who is in command, is one of the few surviving officers who was in the ill-fated battleship *Victoria* when she was sunk by the *Camperdown* off the coast of Syria seventeen years ago. The *Inflexible* has completed her refit and has proceeded to Portland to rejoin the First Cruiser Squadron. Another cruiser, the *Black Prince*, is also out of hand, having gone to Dover to rejoin the Atlantic Fleet. The scout *Patrol* has completed her refit and has rejoined the Nore Destroyer Flotilla. The *Itchen* has had the damage she sustained through stranding off the Orkneys put right, and she has rejoined the Second Destroyer Flotilla at Harwich. The *Porcupine*, whose boilers have been retubed, is to rehoist the pennant here on January 25th, after which she will proceed to Portsmouth for service in the destroyer flotilla at that port. The repair ship *Cyclops* has come in for a refit, as has also the battleship *Irresistible*. The surveying vessel *Triton* has also been taken in hand, and she is to be ready to resume her duties on the East Coast in April. A crew has left the port this month for Bermuda to join the sloop *Alert*, which was paid off at that port four

years ago after serving on the North American station. She is to be commissioned for service on the East Indies station. The sloop, which has been refitted at a cost of £13,000, was built at Sheerness, and she had been seven years in commission before being paid off.

Sheerness Dockyard.

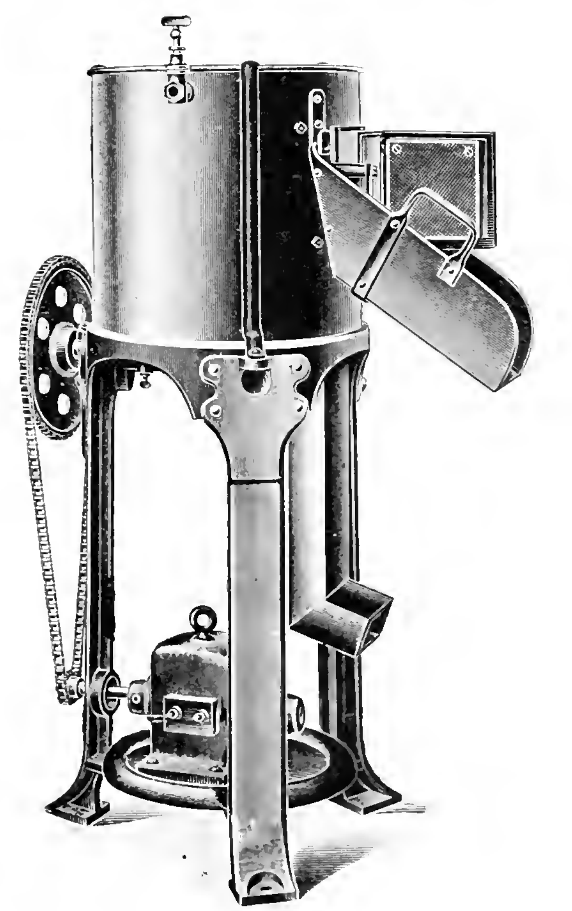
With ships leaving which have been here to give Christmas leave and others arriving for the same purpose, the port has been fairly busy during the month. The battleship *Lord Nelson*, the flagship of Rear-Admiral Briggs, has arrived from Portland, and on January 5th the Admiral struck his flag on relinquishing his duties as Rear-Admiral in the First Division of the Home Fleet. He has been succeeded by Rear-Admiral Sturdee. As regards work, the ocean-going destroyer *Mohawk* and the *Swale* have completed their refits and resumed duty with the First Destroyer Flotilla. The destroyer *Dee* has completed her refit and has been paid off from the First Flotilla and recommissioned for the Second Flotilla. The torpedo-gunboat *Leda* has also been completed, and has left to resume her duties under the Admiral Commanding the Coastguard and Reserves. Submarines C. 2, C. 5 and C. 6, which have been fitted with the new pattern navigation bridges, have gone to Harwich to resume duties in the Nore Submarine Flotilla. Three vessels of the First Destroyer Flotilla are still in hand—the *Saracen*, *Waveney* and *Rother*. The gunboat *Spey* has been docked and was found to have damaged her false keel and to have a hole in one of her plates. The cause of the injuries is not known. The torpedo-gunboat *Hazard*, seagoing depot for submarines at Portsmouth, has been taken in hand for a thorough overhaul. The cruiser *Pomone* which was built at this yard, was in harbour for a short time recently. She was laid up for four years in the River Stour, but has been fitted out at Chatham for duties at Dartmouth, and she was taken round there in tow of the cruiser *Antrim*. The *Pomone* hoisted the pennant in May, 1899, for service in the East Indies, and she was only in commission for five years and three months. A sister vessel, the *Pactolus*, is also in the Stour, but two other vessels of the same class, the *Pelorus* and *Proserpine*, are still in commission on the effective list. Another vessel built at Sheerness has been brought forward for service from the non-effective list. This is the sloop *Odin*, which has been commissioned at Cape Town for temporary service on the East Indian station. The *Odin* was the eighth sloop of the series built at this yard, and was completed seven years ago. She had a very short term of service, having been paid off at Simon's Town and kept there when the Cape of Good Hope Squadron was reorganized. Latterly she has been used as a drill ship for the Cape Naval Volunteers. Staff-Captain Bawden has relinquished the duties of hydrographical officer and has been succeeded by Lieutenant Hanning-Lee, who has come home from Malta to take over charge of the chart office and chronometer depot. Captain Bawden had been here since March, 1906, when he succeeded Commander Barr, who is now Assistant King's Harbour-master at Dover.

Pembroke Dockyard.

Our latest vessel, the cruiser *Blonde*, is making excellent progress. The cast-steel sternpost, which as has been previously stated, was condemned on account of defects due to "air blows," will, it is understood, be used. The casting of the rudder frame for this vessel, and also that for the *Blanche*, which were both condemned for the same reason, will also be used. It would therefore seem that the yard authorities are more particular in dealing with these castings than the Admiralty officials think necessary. It is not possible to measure the progress of the *Blonde* as it has been decided not to record the weights of the structural portions of the ship previous to working them into her. This is due to the fact that the vessel is to be an exact replica of the *Blanche*, and such a record is therefore quite unnecessary. The cruiser *Bellona* left on New Year's Day for her twenty-four hours' acceptance trial of the turbine propelling and other machinery and upon returning the satisfactory completion of the trial was reported, as she had maintained during twelve hours an average speed of 22 knots at full speed without being forced. The ship, however, has not been commissioned as was anticipated. The original intention was to have completed her about March, but as she was in a very forward condition the Admiralty wished her to be passed out of dockyard hands on January 5th. It was presumed that she was more advanced than she really was, and the yard authorities informed their Lordships, who extended the date to the 25th. It has now been announced that she is to be commissioned on February 8th to relieve the cruiser *Sapphire* in the Second Destroyer Flotilla. Captain Alexander Sinclair, of the latter vessel, will take command of the *Bellona*. A singular incident occurred in connection with the *Bellona's* gun trials. The vessel was joined by a gunnery party from Devonport, but a day or two later another party arrived from Portsmouth. The latter had by an error been directed to proceed to the *Collingwood* at Pembroke instead of at Devonport, to which port they went when the mistake was discovered. The refit of the destroyer *Sylvia* is well in hand, and she is to be completed early in May. The return recently issued showing the number of men entered at and discharged from the Royal dockyards between January, 1906, and September, 1909, is of especial interest to Pembroke. At every other yard there has been an increase in the number of men employed. At Portsmouth there has been an increase of 1,864; at Devonport, 1,782; at Chatham, 1,790; at Sheerness, 476; and at Haulbowline, 101; while here there has been a decrease of 286.

MECHANICAL VEGETABLE-PARER.

AMONG the labour and waste-saving appliances introduced on board ship is one in connection with the culinary department, which is shown in the illustration. We had an opportunity of examining one of these appliances at work recently, and it



certainly claimed our interested attention, as befitted an apparatus calculated to effect the saving claimed by the maker's representative. The service rendered

by the machine is the removal of the outer skins of vegetables, such as potatoes, turnips and other tubers, by means of friction, thus serving the double purpose of saving manual labour and the surface of the vegetable immediately beneath the outer skin—considered by connoisseurs of the potato to be of the finest flavour. The machine is mounted on a neat stand, and the case into which the vegetables are placed contains a disc, lined with carborundum or similar abrading material, so formed that on being revolved the tendency is to throw off the contents towards the periphery and the sides of the case—a polygon in shape—on striking which they again fall back on the disc, and so the process goes on till the outer skin is scraped off. A jet of water is kept playing on the revolving disc, so that when the operation is completed the tubers are found to be scraped and cleaned ready for the pot. The mechanism consists of a spindle on which the disc is fixed; motion is given by means of a mitre pinion geared into a wheel on the driving spindle; the power for actuating may be either by hand, belt drive or electric motor. The latter was the system at work on the steamer we were invited to inspect, and the results were quite up to the expectations impressed upon us prior to our visit. Potatoes and turnips were each in turn quickly rendered fit for cooking, save that the deep eyes of the potatoes required outseating. The saving of material is claimed to be 15% to 20%, based on the average weights and the wastages by hand-paring, while the attendant with the machine can clean 40 lbs. of potatoes in about three minutes. The loss in weight by this process of cleaning is about 12½%, while by hand-paring it is considerably and obviously greater; so much so is this the case that the vegetables which can be thus prepared for cooking may be materially reduced in the quantity carried for a voyage, and every saving which can be effected is so much to the good, after making allowance for the capital expended on the labour and material-saving machine. Messrs. McWhirter, Roberts & Co. are manufacturing and fitting these machines in passenger and emigrant steamers, where the saving in labour and material is quite adequate to cover the cost of fitting.

MESSRS. DAY, SUMMERS & CO., LTD., have sold the screw tug *Lady Mackay*, of 96 tons B.M., to the Ceylon Wharfage Co., and she sailed from Southampton to Colombo some days ago. The s.y. *Catania* of 668 tons, owner the Duke of Sutherland, has completed her outfit and has left the yard on charter for a cruise in the Mediterranean.

INSTITUTE OF MARINE ENGINEERS.—The annual ball of the Institute of Marine Engineers was held on Friday, January 21st, at the Abercorn Rooms, Liverpool Street Hotel. A large number of members and friends were present and the function proved eminently successful. Dancing commenced at 8 p.m. and terminated at 1.30 a.m., music being provided by the Salerno Orchestra under the direction of Mr. Clive Parsons. Mr. C. W. Hankin acted as M.C., supported by Messrs. W. E. Farendon, J. H. Redman, J. G. Rendall and A. Robertson as assistant M.C.'s. Included among those present were Mr. J. T. Milton (chairman of Council) and Mrs. Milton, Mr. Jas. Adamson (hon. secretary) and Mrs. Adamson, Mr. J. G. Hawthorn (hon. minute secretary) and Mrs. Hawthorn, Mr. George Adams (member of Council) and Mrs. Adams, Mr. A. E. Battle (member of Council) and Mrs. Battle, Mr. D. Hulme (member of Council) and Mrs. Hulme. The arrangements were carried out under the joint convenership of Messrs. A. H. Mather (hon. treasurer) and John McLaren (member of Council), who are to be congratulated on the success of the gathering.

THE FUNCTION OF THE AIR AND CIRCULATING PUMPS.*

OF recent years engineers have evinced considerable interest in the improvement of the design and efficiency of the condensing plant. This may be attributed to the advent of the steam turbine and the very high vacuum required to obtain economical running with this type of plant. Another reason for this improvement is the more general adoption of condensing apparatus which nowadays is becoming more and more necessary, and in some cases absolutely essential as, for instance, in many modern power stations. These stations for many reasons are situated a considerable distance away from the towns which they supply and they consequently have a very limited supply of fresh water for boiler-feeding purposes, in which case a condensing plant is installed, the amount of water then required being only that lost by leakage and other sources of waste. But even when a plentiful supply of water is available it seems that engineers are beginning to look upon the condensing plant more in the light of a necessity than as a refinement or an additional complication. Of course, in considering the relation between condensing plant and locality the ease of obtaining the necessary circulating water has to be borne in mind, but there are

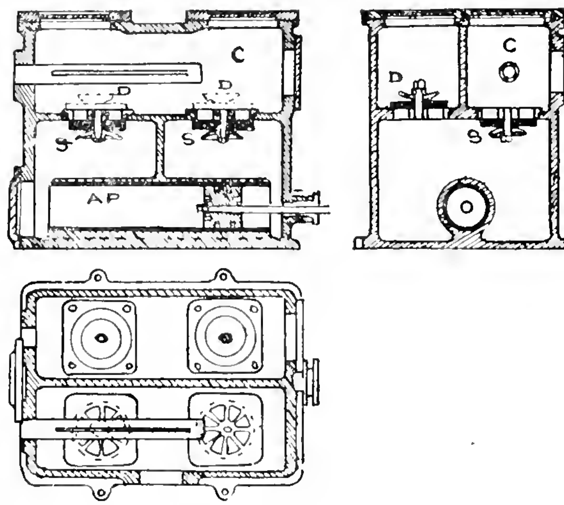


Fig 1

so many various types of condensers, some of which require but a small amount of water per lb. of steam per hour that when used in conjunction with a cooling tower there should be little difficulty in obtaining suitable apparatus for almost any particular case.

With this cursory glance at the present aspect of the condensing plant we must leave the condenser out of the question, and confine our remarks to the air and circulating pumps.

As the name suggests, the air pump is used for exhausting the air from the condenser, but this is not its only function, for it also pumps out the condensed steam and water vapour. In the jet condenser, which is now almost obsolete, it not only pumped out the water condensed from the steam, but also the injection water. This placed the air pump of that time at a considerable disadvantage in places where pure and soft water was not available for use as injection, as, for instance, in marine work, where the boiler feed was taken from the hotwell. This water was practically as salt as the sea water which was used for injection, the sea water and the exhaust steam being in the proportion of about 30 to 1 weight. This to a great extent prevented the use of boiler pressures much above 30 lb., and it was also necessary to periodically blow off a portion of the denser water in the boiler so that it could be supplied with a fresh supply of sea water and so prevent the water in the boiler becoming saturated.

* Prize Essay by Vacuum (Mr. Walter Smith), Graduate, Institute of Marine Engineers. Written for Ritchie Award—Graduate Section.

With the introduction of mild steel plates and improved methods of construction, higher boiler pressures became general, and the question of using fresh instead of salt water became a serious one. This led to the introduction of the surface condenser, the great advantage of which consists in its providing feed water free from salt in solution. This is effected by keeping the cooling water and exhaust steam entirely separate, but even with surface condensers air pumps are necessary, but they may be made much smaller than would be the case with a jet condenser of the same capacity, as a considerable amount of air is brought in with the injection water.

Air pumps are always of the reciprocating type and are usually vertical in action, even when worked by horizontal engines, as this type is found to be more efficient than the horizontal, which is usually of the double-acting solid piston variety. A pump of this type is shown in Fig. 1, working with a jet condenser, the whole being of very simple design and construction. *C* is the condensing chamber and *SS* are the suction valves and *DD* the discharge valves, there being two of each of the indiarubber type. The air pump, *AP*, is fitted with a gun-metal liner in which works the solid piston

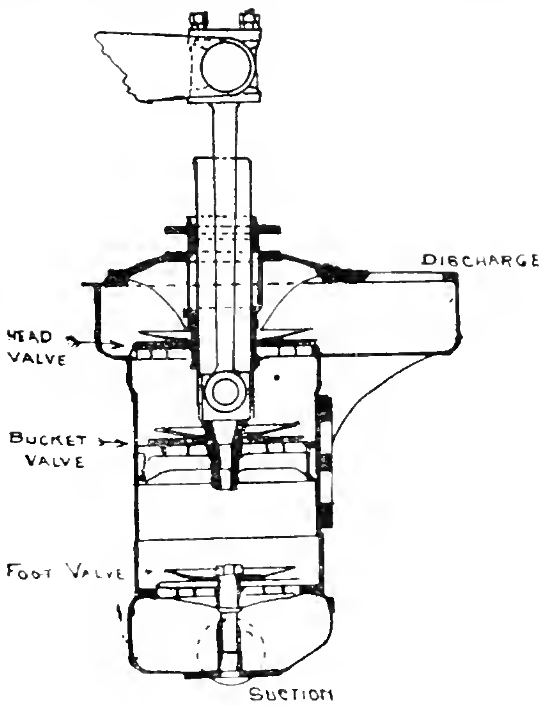


Fig. 2

fitted with two rings of hemp packing. The next figure (No. 2) shows a vertical single-acting bucket pump arranged for working from the L.P. crosshead of a marine engine.

The action is as follows:—On the up stroke of the bucket, *B*, a vacuum is formed in the pump chamber, *C*, causing the air and water to flow in through the foot valves, *F*, owing to the higher pressure in the condenser. On the down stroke the air and water are forced through the bucket valves, *I* until the bottom of the stroke is reached, when the cycle is repeated and the contents of the pump discharged through the head valves into the hot-well; at the same time a fresh charge is drawn in as at first explained.

Mention must next be made of the "Edwards Patent Air Pump," its distinctive feature being the absence of foot and bucket valves, head valves only being required. The pump is of the vertical single acting type and the water flows by gravity from the condenser into the base of the pump, then on the down stroke of the bucket the water is projected silently through the ports in the pump barrel into the chamber above the bucket. The up stroke is now commenced and the bucket in rising closes the ports and discharges the air and water through the head valves. It will also be noticed that as soon as the ports are open there are clear air inlets, the water following immediately afterwards has the slight effect of an injector and so carries in more air than would otherwise be the case, thereby slightly increasing the vacuum.

Another point that contributes to the high efficiency of this pump is that top clearance is reduced to a minimum. This is obviously very important, for before any air pump can discharge, the pressure in the pump must be greater than that of the atmosphere and consequently all air remaining in the pump is compressed. Now when the bucket descends the pressure is reduced and the air in the clearance water is given off and expanding occupies space which should really be available for a fresh supply from the condenser.

But efficient as is the Edwards pump there has during the last few months, sprung up a tendency to fit very elaborate pumping equipment in turbine installations. This is due, as before mentioned, to the increased efficiency of the turbine, with increased vacuum. In a paper by the Hon. C. A. Parsons, and G. G. Stoney, read before the Institution of Civil Engineers, the increase in efficiency was given as follows:—

"On a test of a 1500 kilowatt turbine plant at two-thirds the normal output the effect of an increase of an inch of vacuum at 26 inches is to diminish the consumption by about 4 per cent., at 27 inches by 4½ per cent., at 28 inches by 5½ per cent., and between 28 inches and 29 inches by 6 to 7 per cent. A good vacuum is thereby seen to be much more essential for the turbine than for the reciprocating engine. This

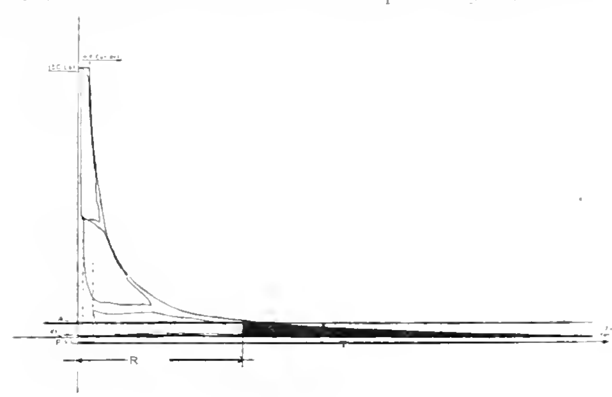


Fig. 3

is shown diagrammatically in Fig. 3, which represents the combined indicator cards of a good triple-expansion engine working with a vacuum of 25 inches. Now if we were to increase the vacuum in the case of the reciprocating engine to 28 inches, the extra energy obtained from the steam is represented by the area of the black portion of the diagram marked *R* horizontally and *dp* vertically while in the case of the turbine an increase of vacuum from 25 inches to 28 inches would mean that extra energy would be obtained equal to the area of the strip of the black portion of the diagram marked *dp* as before, but *T* horizontally, or in other words, the *dp* · *R* portion produced to *T* which will be seen to be a much more considerable portion than in the case of the reciprocating engine.

To maintain this high vacuum there have been introduced two new appliances, namely, the "Dry Air Pump" and the "Vacuum Augmenter." The object of the "Dry Air Pump" is not so much to obtain a good vacuum as to maintain it, as no matter how carefully the condensers, pipes, etc., are erected there is always the liability of air leakage, which would at once mean loss of power, therefore an air pump running at a comparatively high speed and dealing with a large volumetric area was considered to be necessary, and so we have the Dry Air Pumps.

This pump works in conjunction with the ordinary air pump on the suction side of which a large air vessel is fitted, the suction of the dry air pump being taken from the top of this air vessel, and is fitted with a special valve which ensures that air and vapour only may reach the "Dry Air Pump." Under ordinary conditions the Dry Air Pump runs at normal speed, but should difficulty be found in maintaining the vacuum owing to a leak or other contingent reason the speed is increased until the original vacuum is obtained. A small quantity of fresh water is kept circulating in the pump for cooling purposes. The Vacuum Augmenter is connected

between the air pump and the condenser and consists of a small steam jet placed in the contracted portion of a pipe, which leads from the bottom of the condenser to a cooler. The jet draws the water from the condenser and through the cooler to the air pump, so reducing the air to a very small amount.

Before closing the subject of air-pumps it is necessary to mention one or two of the different types of valves in more or less general use. At one time vulcanized indiarubber was

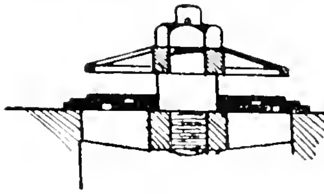


Fig. 4

used without exception, it being especially prepared to resist the action of the oils. When used for naval work the composition was as follows:—Oxide of zinc 70 per cent., sulphur 1¾ per cent., the remainder being best caoutchouc. But nowadays although often used indiarubber is rapidly giving place to metal valves, the best-known type being the Kinghorn, shown in Fig. 4. These valves are made of thin phosphor bronze about 1/32 to 1/16 inch thick, there being three plates to each valve, one on top of the other, of gradually decreasing diameters. They are made to fit loosely on the guide spindle so as to be perfectly free to rise and fall, and it will be noticed that the two bottom plates have holes in them about 3/16 to ¼ inch diameter, there usually being three to four in number drilled at different radii; this allows the valves to come back on their seats more quickly and with less noise than would otherwise be the case. Another type of valve in considerable use is that known as the Beldam, which consists of a corrugated brass plate about 1/16-inch thick with a valve guard corresponding in shape.

We now pass to the circulating pump, Fig. 5, which in marine work is either of the double or single-acting piston type or the centrifugal pump. If the piston type of pump is fitted it usually forms part of the main engine, being driven by means of levers from the L.P. crosshead; but in a few cases it is independent, it then being of the direct-acting steam-driven type. Centrifugal pumps are always direct coupled to a high-speed steam engine. The independent circulating pump has many advantages over the main engine-driven type, for instance, when the main engines are stopped the independent pump may be kept going and so keep the condensers cool.

In many cases where the pump is worked off the main engines it has been found necessary to arrange connections from one of the independent auxiliary pumps to the condenser for circulating when the ship is stopped. Another advantage of the independent type is that when fitted with a bilge suction, which is usually the case, they can be used to pump out the ship in case of emergency. The reciprocating

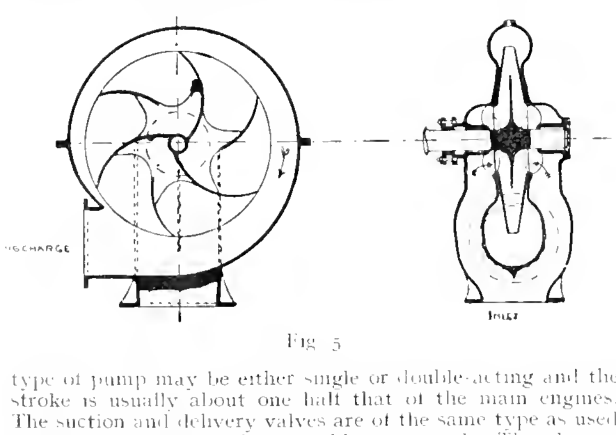


Fig. 5

type of pump may be either single or double-acting and the stroke is usually about one half that of the main engines. The suction and delivery valves are of the same type as used in air pumps, being either of rubber or metal. The plunger is made solid and is nowadays fitted with water grooves in preference to hemp packing.

The work that the circulating pump is called upon to do is very light, there being usually small lift, as the discharge is almost always under water, so that we have only the friction of the pipes and the work required to keep the water in motion. Under such conditions the centrifugal pump is found to work admirably, it being specially adapted to deal with large volumes at small lifts. It has no valves and consequently there can never be dangerous strains put on the pumps or pipes, for should the discharge inadvertently become blocked, the impeller would simply churn the water. With such points as these to recommend it we cannot wonder that it is rapidly gaining favour on both land and sea.

The pump is very simple, consisting as it does of an impeller mounted on a shaft which is directly coupled to the shaft of the engine or motor from which it obtains its power. This impeller works inside a casing of gradually increasing area in the direction of rotation. In this casing are cast the suction and discharge branches. The water enters the impeller at the centre, either from one or both sides, the latter being almost always the case. Should, however, the water enter from one side only, it sets up an unbalanced axial thrust on the wheel, which must then be taken up by means of thrust collars. The impeller is made of brass or gunmetal to resist the action of the water, and consists of two side plates, tapering from the centre to the extreme radius, between which runs a central rib to guide the water into the vanes which are cast between the side plates and extend from the boss to the circumference.

These vanes are curved away from the centre in the opposite direction to rotation and are designed so that the water enters the impeller with the least shock. The shaft on which the impeller is mounted is made of gunmetal or steel cased with gunmetal, the impeller being keyed on. There are two bearings, one at either end fitted with lignum vitæ bushes which are lubricated by the water. At the end of the outside bearing there is fitted a brass cap, the impeller shaft not passing right through. This ensures water-tightness. The inside bearing is, however, more complicated, as in this case the shaft passes right through; it is therefore necessary to fit the bearing with a gland and stuffing box, sometimes a gunmetal bush is fitted inside the gland to take the wear.

This bush is split to allow of renewal without taking out the shaft. The casing is made either of cast iron or gunmetal, being divided at the centre to admit of fitting the impeller.

The pumps to work efficiently must not contain any air, as this seriously interferes with their working; therefore they are always fitted with an air cock at the top of the casing, which is connected to a condenser or air pump chamber so that they may be exhausted at starting. When there is no air pump or condenser available from which to obtain the necessary vacuum a small ejector is fitted on the top of the pump and connected to the steam valve of the driving engine. Then by simply turning on the steam we can easily exhaust the pump of any air it may contain.

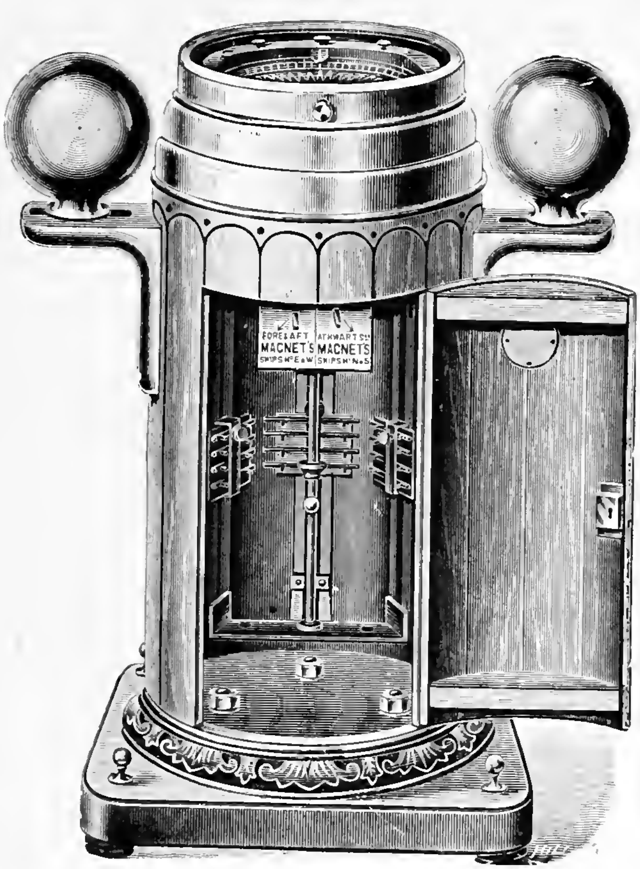
For land installations the air and circulating pumps are often cast together in the form of an oblong box, there sometimes being as many as three air pumps and one circulating pump in the same casting. This conduces to rigidity and compactness. Another point noticeable in modern designs is that the electric motor is becoming the favourite method of driving these plants where current is available. In conclusion, we think that as far as efficiency is concerned the present-day air pump leaves very little room for improvement, as I have had the pleasure of seeing an Edwards double-acting air pump working at a vacuum of 29·5 inches of mercury by the mercury gauge, the barometer at the time standing at 29·8 inches.

MESSRS. VICKERS, SONS & MAXIM, LTD., Barrow, have placed an order with Masons Gas Power Co., Ltd., Manchester, for a shipyard furnace plant, consisting of gas producers, ship frame furnaces, steel chimney, the necessary flues, etc.

CAPTAIN WARD, of the *Campania*, succeeds Captain Pritchard, of the *Mauretania*, as commodore of the Cunard fleet, and will hoist his flag on the *Campania* as soon as that vessel completes her overhaul. Captain Ward joined the Cunard Line's service as junior officer in 1880, and has commanded many of the company's steamers. Of late years he has been in command of the *Caronia*, *Carmania*, *Lucania* and *Campania*

HUGHES' NEW STANDARD COMPASS.

We think that shipowners should take the trouble of looking into the merits of the latest and most important form of standard compass which has been put on the market by Messrs. Henry Hughes and Son, Ltd., of 59, Fenchurch Street, London, E.C. We would specially direct attention to the following important improvements which have been embodied in the new design. In the first place, the compass itself is an improved construction of a spirit compass electrically illuminated from below, and having a specially designed binnacle provided with geared motion to the correcting magnets for affording



ease and accuracy of adjustment. The binnacle top is fitted with sighting arrangement for distant objects, and, further, with the new Cowie Azimuth instrument for taking bearings without removing the binnacle top. It is claimed that all these features give better results in the state of efficient working of the compass at sea, and some of them are installed in the new Admiralty standard compass now being supplied to H.M. ships. It is interesting to note that the original compass of this type was patented and introduced by the same firm nearly twenty years ago, so that its retention, as an effective type, after so many years is strong testimony as to the solid merits which it possesses.

MODERN SHIPYARD MACHINERY AND EQUIPMENT.—The series of articles on Modern Shipyard Machinery and Equipment will be continued in our March issue.

ENDALL'S PATENT SIGNALLING LAMP.

It is now fully recognised as a matter of importance that ships should be able to communicate with each other by day and night by means other than that involved in wireless telegraphy, and it may be said that hardly a ship leaves port to-day without having on board some kind of Morse Code Lamp. Many of the devices in use, however, are not well up in capacity, either as to effective range or simplicity of manipulation, and in fact in many cases are merely small hand lamps. Owners are now recognising the value and convenience of their ships being able to communicate with the various signalling stations round the coast, and are therefore fitting their ships with a more efficient type of lamp. A lamp of this description, which is attracting a good deal of notice, is the Endall's Patent Morse Code Lamp, which has been specially designed to comply with the Admiralty recommendations to the Board of Trade. It is a complete electric lamp mounted on a pole with a revolving shutter, and adapted to flash a powerful light from a lens of 130° angle in any required direction. By means of this device signals can be clearly and quickly transmitted, and distances of fourteen miles can be covered. The manufacturers of this lamp are now combining it with a semaphore arrangement so as to have in one device the combination of day and night signalling apparatus, which is being put upon the market under the title of the "Morsaphore." Prices and further particulars may be obtained from 101, Leadenhall Street. E.C.

THE CARE OF SHIPS' ELECTRIC INSTALLATIONS.*

By Mr. T. R. STUART, M.I.Mar.E.

THE authors and critics of recent papers on electrical subjects read before the Institute have frequently made disparaging remarks on the electric equipment of ships.

It is likely that in the near future the uses of electricity will be greatly extended. I think, therefore, that it will be profitable to consider some of the causes of breakdowns in connection with electrical machinery and fittings, and how they may be avoided.

All large insurance companies dealing with property ashore or afloat have a list of rules and regulations for an electric installation; they are usually loosely worded and on the whole they combine in demanding that it must all be good and satisfactory work. They are designed to give great freedom to electrical engineers when introducing new designs. There are, however, many cases where "should" might be changed to "must" with advantage. On the whole the system works well, and I think the rules are kept in spirit as well as in the letter.

A large insurance company in their book of rules and regulations for an electric installation prints the following:—"The principal sources of danger are (1) Bad materials and workmanship, especially bad joints; (2) Conductors of inadequate size; (3) Perishable and inferior insulating materials; (4) Neglect of frequent test and inspection; (5) Moisture; (6) Dust and dirt; (7) Undue heating."

I would add for marine work, the absence of facilities for the experience of marine engineers to be conveyed to the manufacturers of electrical plant and fittings.

No. 2 does not apply to marine work to any great extent, the conductors are usually of ample size when new, the workmanship on new work is usually quite satisfactory so far that fittings and wires are put up conscientiously. There are,

* Read before the Institute of Marine Engineers on Jan. 31st, 1910.

however, many fittings installed by eminent electrical firms of great experience that are always a source of annoyance and frequently of danger. I have seen the same parts fail so many times, that I conclude that although quite electrically sound when new, they contain many undesirable features.

Nos. 3-6 are all likely to be found on any ship; the keynote of their prevention is frequent inspection.

Those who have carried rubber stores down the Red Sea and through a monsoon have a good idea of what rubber is like after the ordeal. Many rubber goods, although they readily stand the required 180°F. without softening, crack or become pasty under continued heat. The rubber insulation of wires in hot places usually becomes quite hard and loses all its rubber qualities, including flexibility and water-tightness after a few voyages. You can easily imagine that in this condition fine cracks abound, then follows a monsoon when everything is dripping, and salt spray everywhere soon finds out the copper wire, corrosion follows—usually a slow process. All the moisture that did the damage has probably dried up, leaving the wood casing like tinder. The reduced wire becomes red hot, and finally, after days of charring, the wire parts with a flash and ignites the wood which has been so carefully prepared. I have seen many instances of this; sometimes the fire speedily goes out, and sometimes the smell of burning attracts attention to it and it is put out, but I think that it is not sufficiently realized that while these conditions exist there is always a danger of fire. We cannot always look for such a happy ending, and at some time one of these small fires may develop into serious proportions before discovery.

It is when a wire fails and is repaired hurriedly or carelessly that the bad workmanship occurs. Marine engineers are, early in their career, imbued with the instinct of "Keeping things going." If an important wire fails, a temporary wire is run up, the ends twisted together and roughly insulated. These temporary measures are always risky and should only be resorted to when really necessary, and a thoroughly good job should be made as soon as possible. A bad contact speedily gets worse, and the old trouble is renewed, with this difference—the original insulation is to a great extent fire-proof, but the rubber tape and black cotton insulating tape both burn readily, as you may test by applying a match. In looking for a remedy the first thing is to discard the wood casing; it only hides the wires without protecting them. If the existing wires were open to view they could be frequently varnished and kept water-tight, and any deterioration noticed at once. Armoured or lead sheathed wires are necessary for all damp places.

Fuses are the safety valves of the system, and should be respected accordingly. The following are extracts of rules concerning them:—

"They should be mounted on slate or other incombustible bases, and be arranged so that the fused metal may not be a source of danger, and where fitted with covers these should be incombustible. The fuses for each cable should be made of standard dimensions, so that a large fuse cannot be used for a small cable by mistake, or if wire fuses are used permanent instructions should be fitted, giving particulars of the proper size of fuse for each circuit.

"In damp places all lamp switches and cut outs should be of a strong water-tight pattern."

In the kind of fuse box often fitted many points are open to criticism. It is of no use having a slate base pierced by large holes allowing fire, water and dirt to have a free passage. These boxes are usually full of ants or cockroaches, they are easily opened by people who should not have access to them—any knife blade will do it. There is no limit to the strength of fuse that may be put in. I have seen one fuse carrying three lights and two fans, others with seven 16 c.p. lamps. The fuses are of a very poor design, the distance across the narrow bridge is very small, the central screw is just where it should not be, as an arc once started is readily carried on by it. When a fuse melts, the wire end is often burnt where it leaves the box through the slate base. The frames would be better if metallic and water-tight; these boxes are fitted in alleyways where the paint is washed down with abundance of water, and are certainly "damp places." They should exclude vermin and be accessible to the charge-engineer only. The size of fuse should be strictly limited to suit the circuit. Before renewing a fuse, the lamp and wire leading to it should be examined for intermittent breaks, partial earths, etc. If the lamp glows for a few minutes and then the fuse melts again, it should not be renewed till the cause has been ascertained. The most frequent breakdowns occur in that part of the installation used for portable cargo clusters. When new, everything appears to be good and well insulated, but troubles soon develop, the wood speedily shrinks or warps and lets in water back and front.

The wire is bared and there is only about $\frac{1}{8}$-inch gap between the positive and the nipple acting as negative, and this is often filled with water during a shower. The brass caps are nearly always lost. I do not see what useful part the wood base takes as the brass base can be screwed to the iron plate as easily as the wooden one, neither do I see any use for the spring or distance piece; they do not give a quick break or serve any useful purpose whatever. The wire terminal makes no pretence at being water-tight, and certainly never is. Another small but important point is, that the fine thread is unscrewed when the terminal is screwed in place owing to the friction at the collar, and this often pulls off the nipple. On a ship having ten of these cargo lights it is quite common for six or eight to fail during a heavy shower. The cables, too, are not strong enough for the rough treatment they receive. I have seen them sparking and spitting fire; this only wants to occur in a hold full of cotton to start a big blaze. The chief trouble with these portable wires after dampness is that they get kinked and that cuts the inner insulation and allows the wires to come together.

Navigating lights are the most important of all, and no effort should be spared to make them reliable. There are usually one or two 16 c.p. lamps fitted into a lantern designed for an oil burner, and ventilated accordingly. I have seen them half filled with water and, of course, the lights go out just on the rough night when an oil lamp too gives most trouble. These lamps should be simple copper boxes having a lens as required, glands where the wires pass and rubber joints on the door, with a good cable leading to a switch and fuse in a sheltered place. Any electrician could make a good job of it if not bound by precedent. I remarked that the fuse boxes should be kept locked; the same principle should apply throughout. The installation should be treated seriously and irresponsible persons not allowed to interfere. Temporary cabin lights hooked on to bared wires, amateur wire heaters, and second hand nondescript fans should be prohibited, and any interference with any electric fitting viewed as a serious offence.

Steps should be taken to remove the slur cast by shoddy electric work, otherwise it will not be long before it is added to the list of parts to be regularly surveyed in detail. From an underwriter's point of view it is bad finance to underwrite a ship that may be totally lost through any of these trivial causes. In conclusion, I would ask members who have control of such gear to consider their own position if loss of life or property occurs through improper work by any of their staff.

INSTITUTION OF NAVAL ARCHITECTS.—The annual meetings of the Institution will take place on Wednesday, March 16th and the two following days, in the Hall of the Society of Arts. The annual dinner will be given on March 16th, in the Grand Hall, Hotel Cecil.

EXAMINATION OF ENGINEERS.—Instructions to Examiners and Notice to Candidates.—Qualifications for a second-class certificate of competency as Engineer of vessels propelled by oil engines available for home-trade passenger ships only. On and after January 1st, 1910, candidates may be examined for the above certificates, among the qualifications for which are the following:—(1) A candidate for a second-class certificate must be at least twenty-one years of age. (2) He must prove: (*a*) Four years' experience at the making or repairing of machinery, of which at least six months must be at the making or repairing of oil engines. (*b*) Three and a half years' experience in charge of engines and boilers at sea or an equivalent suitable experience on shore; and, in addition to either (*a*) or (*b*):—(*c*) Six months' experience with oil engines at sea. NOTE.—Alternative service to the above may be considered, but it is essential that the candidate should have experience with oil engines, and have spent at least six months at sea in the engine room of a sea-going vessel.

List of Vessels Launched in 1909.

(Continued from page 244).

ENGLISH.

ROYAL DOCKYARDS.

H.M. Dockyard, Devonport.

Indefatigable (particulars not available for publication).

WORK ON HAND.

Collingwood, completing, dis. 19,250 tons.
Lion, building.

H.M. Dockyard, Chatham.

Atlas, Pilot, T.S. steel tugs; Submarines C. 19 and C. 20; 2 Self-Propelled Store Lighters (100 tons); 2 Store Lighters (60 tons).

WORK ON HAND.

C. 109 (late Agincourt), C. 33 and C. 34 Submarines, Pomonde, Naiad, Intrepid St. George. Several large and small refits are also being carried out.

AMERICAN.

The Great Lakes Engineering Works, Detroit, Michigan, U.S.A.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Theo. H. Wickwire	—	Buffalo	—	5,141	1,520
† Clifford F. Moll	—	,,	—	5,141	1,520
Ulster, Munster Leinster, Connaught	—	,,	—	—	—
a North Sea	—	,,	—	3,921	1,700
a North Lake	—	,,	—	3,921	1,700
a North Star (Launched, not delivered)	—	,,	—	3,921	1,700
† Shenango	—	Pittsburgh	—	8,047	1,880
* G. A. Boeckling	—	Sandusky	—	328	550
† Stadacona	—	Michigan City	—	6,014	1,520

Wm. J. Olcott, Wm. B. Dickson, Wm. P. Palmer, Harry Yates and 4 hulls on hand.

The Detroit Shipbuilding Co., Detroit, Michigan, U.S.A.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
a Alpena	—	Detroit	—	2,880	1,400
† Benj. Noble	—	,,	—	1,481	800
a Conemaugh	—	Erie	—	3,898	1,700
† Rochester	—	—	—	1,603	2,000
a Octorara	—	Erie	—	4,330	2,500

Total Tonnage on hand, 17,000 tons.

T. S. Marvel Shipbuilding Co., Newburgh, New York, U.S.A.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
b Rensselaer	Steel	Albany	1,377	2,571	2,500
* N. Y. Central, Nos. 17 & 26 ..	,,	New York	225ea	230ea	500ea
** Dutchess	,,	Albany	574	825	650

Tonnage on hand, 1,669 tons.

DUTCH.

A. J. Otto & Son, Krimpen ad Yssel, Holland.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Ideaal	Steel	Rotterdam	400	—	—
Braunchiveig	,,	Holzmunden	650	—	—
Westfalen	,,	Bremen	650	—	—
Nos. 34 and 37	,,	Duisburg	1,825ea	—	—
Herman	,,	Rotterdam	340	—	—
Ibis	,,	,,	360	—	—
Embrica	,,	Devenler	500	—	—
Josepha and Kaiser Wilhelm II.	,,	Millenberg	625ea	—	—
Preussen	,,	Schlusselburg	650	—	—

On hand:—2 cargo boats, 1 passenger steamer for London, 1 lighter for Germany.

J. Meyers Shipbuilding Co., Zalt, Bommel, Holland.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Seven Lighters	Steel	German	—	3,849 d.w.	—
Three Seagoing Lighters ..	,,	,,	—	1,500 ,,	—
Two Lighters	,,	Belgium	—	670 ,,	—
Four ,, ...	,,	Dutch	—	1,420 ,,	—
Bucket Dredger, Flevo ..	,,	,,	—	400 ,,	—
,, ,, Pannerden	,,	,,	—	600 ,,	—

J. & K. Smit's Scheepswerven, Kinderdijk, Holland.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† M.O.P. 21 C., Bucket Dredger		Buenos Ayres	350		550
* M.O.P. 22 C. ,,	—	,,	200	—	200
† Zeeland, Pass. Steamer ..	—	Vlissingen	300	—	800
* No. 615, Barge unloading Dredger	—	Goteborg	140	—	275
No. 616, Crane Pontoon ..	—	Rotterdam	350	—	—
* Torpedodienst II., Tug Boat	—	Gravenhage	50	—	100
No. 1 and No. 2, Hopper Barges	—	Valparaiso	200ea	—	—
* Piloto Campbell, Tug Boat ..	—	,,	75	—	150
† La Loire, Bucket Dredger ..	—	London	600	—	1,100
‡ Politie II., Service Steamer ..	—	Rotterdam	50	—	200
* Stad Venlo II., River Cargo Steamer	—	Lith	125	—	90
† Bayern, Barge unloading Dredger	—	Greitenhagen	450	—	900

Total tonnage in hand, 860 tons.

C. M. Van Rees, Sliedrecht, Holland, has launched 31 pieces, totalling 6,386 tons.

* Compound. ** Double Compound. † Triple. *a* Quadruple. *b* Beam.

ITALIAN.

Fortunato Menetto, Chioggia, Italy.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Nicolo Tommaseo	Steel	Venezia	730	740	400

On hand:—One 3-masted topsail schooner, with auxiliary motor.

E. Moseati, Salerno, Italy.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Salerno	—	—	250	—	—
Alba	—	—	100	—	—
Aurora	—	—	98	—	—
Giauheth	—	—	30	—	—

The above arrived too late for our January issue.

REVIEWS.

A Practical Handbook on Sea Water Distillation. By Frank Normandy, Barrister-at-Law. Price 6/- net. Messrs. Charles Griffin & Co., London.

This is a manual on the subject of the distillation of sea water and other impure waters for drinking and other purposes, and the main subject is divided into three fundamental heads—water, steam and fuel. Detailed description is given of the various classes of apparatus used in the process of distillation, both for ship and land purposes. It is somewhat refreshing to find an author who belongs to a learned profession, accustomed to deal, more or less, with dry detail, launching out in the writing of a technical treatise upon such a practical subject as distillation, and we think that the apology the author has made in presenting his work to the public is quite unnecessary, having regard to the useful character of the work produced. The analytical treatment of the general features of the problem is concise and comprehensive in its scope, while the description of the apparatus, involving the elaboration of important details and their use leaves little to be desired. While the capital outlay in the apparatus necessary must only form one item of importance in deciding the cost of distillation, a still more important factor is the cost of the fuel used in the process. The author has taken some considerable trouble in setting out in detail, not only a theoretical basis of comparison, recognised by authors as the best that science can give, but states the results under various conditions of use from a variety of fuels such as coal, coke, patent briquettes, wood, petroleum and town gas; and after dealing in detail with this branch of the subject summarises the points prominently brought out. Naturally a good deal of the matter as far as the apparatus is concerned refers to devices which have been for years associated with the name borne by the author, but having regard to the wide use and efficient working of such apparatus the information set forth, particularly as to points involved in actual use, must be valuable to those who desire to make themselves acquainted with the special features of operation on which efficient working depends. While the subject has been treated rather exhaustively the author has refrained from clothing his description with any large amount of technical phraseology, and in this direction we think that the book, while being useful to experienced engineers, will appeal with probably greater force to students and to those whose technical training does not extend into the higher branches of science involving somewhat abstruse mathematical treatment. On the whole it may be said that the effect on the mind of the serious student will be to lead him into a line of development or research so as to improve the present performance of known apparatus. In this way the book is a useful addition to existing knowledge, and at the same time an encouragement and stimulant to the carrying out of improved working, and to the improved construction of apparatus to increase the results obtained from fuels at present obtainable on the market at different parts of the world, where distilling apparatus has become an absolute necessity for dealing with well known and defined wants.

Elementary Treatise on Electricity and Magnetism. By G. Carey Foster, F.R.S., and A. W. Porter, B.Sc. 10/6 net. Longman, Green & Co., London.

We have before us the third edition of this work, which has followed the second edition in an interval of six years. The book was first written, following closely on the lines of M. Joubert's Traité élémentaire d'Electricité, but it was decided at the time of publishing the second edition whilst

adhering to the general plan and scope of the original, to endeavour to introduce into it that view of the nature of electrical phenomenon which was originated by Faraday and developed by Maxwell in his classical treatise. Certain parts that were changed in the second edition were the chapters dealing with the theory of the dynamo-electric machines. Amongst the principal additional matters introduced mention may be made of the theory of electric images as applied to the mutual electric influence of spherical conductors; the idea of ionisation of electrolytes; the propagation of electric waves along a concentric cable, and of a plane wave in an unlimited isotropic medium; the properties of the cathode stream of Röntgen and Becqueral rays, etc.; the Zeeman effect, and a brief account of recent investigation bearing on the theory of electrons. In the chapters on magnetism, Gauss's law of the inverse-cube of the distance, for the field due to a small magnet, has been taken as the experminental starting-point for the quantitative discussion of magnetic action in place of Coulomb's law of the inverse square as applied to magnetic poles. It is to be noted that the term "influence" is used instead of "induction," in reference to the condition of a conductor in an electrostatic field, the term "induction" being reserved to express what Maxwell calls electric displacement. The final chapter of this edition has been entirely rewritten, and it gives an excellent up-to-date summary of recent progress in electrical science. The whole book has been carefully revised and many additions made.

The Practical Engineer Pocket Book and Diary for 1910. Cloth, 1/- net; leather, 1/6 net. The Technical Publishing Co., Ltd., London.

THE proprietors of the "Practical Engineer Pocket Book and Diary" have issued their annual edition, in which opportunity has been taken to include additional matter, beside revising much of the standing portion. Much useful information is contained in its 684 pages, and the price is such that the book is brought within the reach of all. Some of the items, comprising the additional information included in this edition, are—Fuel testing, condensers, friction of air and water in pipes, alloys, table of properties of metals, pyrometry, suction gas producers, emery grinding, etc. The article on steam turbines is well set out with several good diagrams. That on gas and oil engines is full of information, full tables and results of nearly all the different engines being given, and a comparison between the performances of a considerable number of gas engines is included. Engineers will find the book of great use.

CATALOGUES.

Siemens Brothers' Dynamo Works, Ltd., have sent us a list of lantern slides in stock, showing a great variety of the Siemens' manufactures. The slides are available for lectures, demonstrations, etc., and the firm will be pleased to loan them free of charge.

Westinghouse Brake Co., Ltd.—A new catalogue has just been issued of the company's Silent Rocker-joint chain drives. The catalogue is well illustrated, showing the application of the chains to various drives. The company informs us that they are furnishing these drives for every kind of high-speed power transmission.

J. P. Hall & Co., Ltd.—We have received a copy of the company's new and revised crane motor list which contains a considerable amount of fresh information. Every firm interested in electric drives, where the load is intermittent and the duty severe, such as capstans, winches, punching, drilling and boring machines, rolls, saws, planes, should send for a copy.

Barrow and District Association of Engineers.—We have received the first volume of the transactions of the Barrow and District Association of Engineers. The association was first incepted on the 26th of March last, and at a general meeting held on May 11th, the bye-laws and constitutions were adopted and the president, vice-presidents, and Council elected. The president is W. F. Pettigrew, M.I.C.E., etc., the hon. secretary is J. W. Osborne, and the editor of the Transactions G. W. Buckwell. The volume contains, in addition to the president's interesting address, some very good papers on fuel and its combustion, boiler explosions and their causes, the manufacture of weldless steel tubes, iron foundry practice, the direct current electric motor, the engineering text book, spiral gear formulæ, graphical aids to the design of spiral gearing, factory cost keeping and the use of steel castings in railway rolling stock. We wish the association every success.

Graphite Products, Ltd., of Queen's Road, Battersea, have sent us a copy of their organ "Graphite," for the month of December. It contains much interesting matter, and we understand that they will send copies free each month to all who are interested in the use of graphite.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

SINCE the resumption of work after the New Year Holiday period, operations in Clyde shipyards and engine works have been carried on under cheering enough conditions as to work on hand and in prospect. Contributing very materially to this state of affairs is the large amount of naval work recently booked, although much of it cannot, according to British Admiralty regulations as to paying for work done, be advanced to the stage when all branches of workers participate until well on in the spring. With the "fierce light" and criticism thrown on naval matters through the General Election, there is—one may with much certainty predict—further naval work not far distant for the Clyde and other centres, whatever party may be returned to power, which at the moment of writing is uncertain.

Castle Liners.—The most notable event in the Clyde shipbuilding industry since the year began was the launch of the *Garth Castle* from the yard of Messrs. Barclay, Curle & Co., Whiteinch. Like her sister ship, the *Grantully Castle*, launched in October from the same works, this vessel is intended for the intermediate service of the Union-Castle Line to South and East Africa.

Fresh Orders.—Only a very limited amount of fresh tonnage has been placed with Clyde builders since the New Year began, and subjoined will be found the most important items booked since the notes for last issue were penned:—

Messrs. Alexander Stephen & Sons, Linthouse, have been commissioned by the British-India Steam Navigation Co. to build and engine a steamer of considerable size and of 17-knot speed for the inter-colonial trade with Australia. A second and sister steamer has been placed elsewhere on the Clyde as afterwards noted.

The Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, have secured a contract to re-boiler and overhaul the machinery and hull of the Brazilian cruiser *Barossa*, which will shortly proceed from the Tyne to the Clyde. She brought a crew to Newcastle for the battleship *Mines Geraes*, and subsequently landed her guns for treatment at Elswick by Messrs. Armstrong, Whitworth & Co., Ltd. It is of interest to add that one of the last contracts placed by the late Sir Alfred Jones was secured by this Port Glasgow firm, whose managing director, Mr. Donald Bremner, was for many years at the Clydebank works. This was to lengthen the Elder-Dempster steamers *Zaria* and *Muraji*. In a short time, therefore, Port Glasgow will be busier on repairs than it has been for some time.

Messrs. William Denny & Brothers, Dumbarton, have received an order from the British India Steam Navigation Co., Ltd., for a passenger and cargo steamer for their service in the East. It is similar to the vessel ordered at the same time from Messrs. Alex. Stephen & Sons.

Messrs. A. McMillan & Son, Ltd., Dumbarton, who have on hand a steamer whose construction is on the longitudinally-framed principle, devised by Mr. Isherwood, are also about to lay down a steamer of the "straight-back" type, devised by Mr. Henry Burrell, Glasgow, one of which has already been built on the North-East Coast of England for foreign owners. The new vessel will be largely owned by the inventor. The "heritors" of Dumbarton have empowered a committee to complete the agreement with this firm for the purchase of a portion—some 1030 square yards—of the parish churchyard for an extension to their shipyard.

Messrs. A. Rodger & Co., Port Glasgow, have contracted to build a steel screw steamer 225 ft. in length, 33 ft. in breadth, and 16 ft. 8 in. in moulded depth, and carrying about 1500 tons deadweight. The vessel is for the New Zealand Shipping Co., Ltd., London, and is intended for the New Zealand coal trade. The machinery will be supplied by the builders from their engine works at Helen Street, Govan.

Messrs. Murdoch & Murray, Port Glasgow, have contracted to build two passenger and cargo steamers for South America. These will be of moderate dimensions and one will be a single screw and the other twin-screw.

Messrs. John Reid & Co., naval architects, Glasgow, have placed a contract with Clyde builders for a steamer for service on the Canadian Lakes.

Messrs. Hawthorns & Co., Ltd., Leith, have at present on hand for Messrs. C. Salvesen & Co., Leith, three steel screw whalers, intended for the owners' whaling station in the South Atlantic.

Messrs. Hall, Russell & Co., Ltd., Aberdeen, have been commissioned by Messrs. John T. Rennie & Son, Aberdeen, to build and engine a steamer of 380 ft. length for these owners' South African passenger and cargo trade.

Projected New Clyde Dock.—At a meeting of the Clyde Trust, held on January 4th, Sir Thomas Mason, the chairman of the Trust, in reviewing the progress of Glasgow's harbour and docks, said that the plans for the use of their ground at Renfrew were remitted to a special committee, who were still considering the subject. Affairs were considerably advanced, the engineers had the plans pretty well in hand, and the Admiralty had approved of the size of the dock, but there still lay before them the question of the utilization of the adjoining land. The land was all paid for, and if the plans could be determined upon by the present trustees, they might, he thought, without any precipitation take steps for securing a Provisional Order by the end of the year, so that if the trade progressed they could make progress with the work in that district and in every way meet that trade when it came. Altogether, he felt that the Clyde Trust at this moment had never been in a better position for carrying on its work or for meeting an increased and expanding trade should it come suddenly upon them.

Large Steel Furnaces.—Messrs. David Colville & Sons, Dalziel Steelworks, Motherwell, have in their existing arrangements for smelting three distinct types of stationary regenerative furnaces in operation, each marking an upward step. There is first the oldest type, of which there are thirteen in number, having capacities ranging from 25 to 30 tons each. They are all "charged" in the old way by hand. In shop No. 3 there are eight more furnaces, six of which are capable of taking charges up to 60 tons, whilst the two latest are of a capacity sufficient to deal with the extraordinary charge of 100 tons. All the furnaces are charged by huge electrically-operated machines, of which the shop contains two. These charging machines effect a considerable saving in the cost of production. This new plant represents the culmination of present-day development in the direction of capacity, and it is an honour to Messrs. Colville, as well as a distinction to the West of Scotland, that in this department they should have boldly out-distanced all their rivals. The largest furnace of this type believed to be in existence in America—the land of big things—is 60 tons. With the additional facilities afforded them by the installation of these giant furnaces—which provide the firm with a grand total of twenty-one—the aggregate monthly output of steel at the Colville works has been increased to 28,000 tons. From this array of furnaces Messrs. Colville & Sons cast ingots ranging from 3 to 20 tons for use in their plates and structural sections, while ingots up to 50 tons weight are prepared for forging purposes.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, were reported to have secured the contract to build two large cargo steamers. These are said to be to the order of Messrs. Furness, Withy & Co., shipowners, West Hartlepool.

Messrs. W. Harkess are finishing work on hand, nothing new being reported during the month.

Messrs. Richardsons, Westgarth & Co. are stated to have the order to fit engines and boilers into the two steamers building by Messrs. Sir Raylton Dixon & Co., Ltd. All their engines are now fitted with the contraflo type of condenser, for which they have several orders on their books.

Messrs. Walker, Maynard & Co., Redcar Ironworks, are closing down owing to the coal trade dispute, and Messrs. Bolckow, Vaughan & Co. have closed their plate mill at the Eston Steelworks, where they have a considerable amount of work on hand. The whole of the North-Eastern steel works at Middlesbrough are closed for an indefinite period. Some days ago the damping down of two American up-to-date furnaces was reported, which is a serious matter for the neighbourhood, several hundred employees being affected. The damping down of the three blast furnaces involves the closing of the steel works which are dependent upon the furnaces for supplies of pig iron; it is stated that there is not a single plate mill in the district now working.

The Teesside Bridge and Engineering Co. have secured an order for forty-two bridge spans intended for a bridge for the central Argentine Railway.

Messrs. Dorman, Long & Co. have been entrusted with the order to extend the machine shops at Devonport Dockyard for the British Admiralty.

Stockton and Thornaby.

Messrs. R. Ropner & Son are busy with the work on hand, and are also reported to have secured an order for a large cargo steamer, but nothing definite is known.

Messrs. Craig, Taylor & Co. have secured an order to build a 7500-ton steamer for Messrs. Allan, Black & Co., Sunderland.

Messrs. Richardson, Duck & Co. have contracted to build a cargo steamer for Messrs. Anning & Bros., shipowners, Cardiff.

Messrs. Blair & Co. are busy with work on hand, and have secured the order to fit the engine and boilers into a steamer to be built by Messrs. Craig, Taylor & Co., also of Stockton, for Sunderland owners.

West Hartlepool.

Messrs. W. Gray & Co., Ltd., are now fairly busy at both the old and new yards, also at their Central Marine Engine Works, overtime being worked in the pattern shop and some other departments. It is stated that they have sufficient work in hand to carry them through the year, having just booked an order for two cargo steamers for Messrs. Pyman, Bell & Co., London.

Messrs. Irvine's Dry Dock and Shipbuilding Co., Harbour Dockyard, are busy in all departments. The new Tyne-Tees boat will be 290 feet long, 37 feet beam and 17 feet draught, and not as stated in our December issue. It is understood she will be christened the *Stephen Furness*.

Hartlepool.

Messrs. Richardsons, Westgarth & Co. have plenty of work in hand, and are reported to have secured the contract to supply the machinery to a large cargo steamer to be built by Messrs. J. L. Thompson & Sons, Sunderland. They have also secured the contract for engines and boiler for a steamer for Messrs. Allan, Black & Co., Sunderland, for early delivery.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Middleton Co.-Partnery yard, is fairly busy. They are reported to have secured the order to build two steamers for local owners, and also a 7450-ton deadweight cargo boat for the Albyn Line, Ltd., to the order of Messrs. Allan, Black & Co., Sunderland. At this yard for the nine months ending December, 1909, they decided to pay a bonus of 5 per cent. over the 4 per cent. guaranteed, making 9 per cent., a very creditable record. It is rumoured that the new elected M.P. for the borough, Sir Christopher Furness, intends building another twenty steamers, but not all necessarily in the local yards, which shows confidence as to the state of trade in the near future.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

Messrs. Earle's Shipbuilding and Engineering Co., Ltd., are gaining fresh orders every month. The large paddle tug H.M.S. *Hellispont* is fairly well on. The s.s. *Livorno*, Wilson liner for the Baltic and Mediterranean trade, is well

forward and will soon be in commission. S.s. *Normandy*, built to the order of Joseph Constant, Esq., London, for the Baltic and White Sea trade, was launched on 15th January (see Launches). They are also building four new steamers, cargo and passenger service, for the Great Central Railway Co., to run between Grimsby and Hamburg, to be of high speed. A large twin-screw steamer for the (Wilson line) Norwegian trade is in hand, to run weekly voyages, Hull to Christiania, leaving Hull every Saturday, Christiania every Wednesday, with a speed over 18 knots, making the passage in about twenty-five hours. The Post-Master General has arranged for the mails to be dispatched from Hull, instead of, as at present, by foreign-owned steamers *via* Newcastle. The vessel is to be of the following dimensions :—330 ft. by 45 ft. by 27 ft. 9 ins. They have also got an order to build a fast steamer for Wilson's and North-Eastern Railway Co., for passenger, cargo and fruit trade. Several sets of engines and boilers for abroad, for placing in steamers are in hand. Alterations are being carried out on the s.s. *Bruno* and s.s. *Seagull*, and other repairs on ships.

Central Dry Dock and Engineering Co., Ltd., have plenty of repair work always in hand, and have docked the following: s.s. *Ragnar*, of Copenhagen, extensive bottom repairs ; s.s. *Lilly*, of Helsingborg, stem damage repairs, also engine and deck repairs ; s.s. *Thornley*, of West Hartlepool, damage due to collision, stem and bulwarks, etc. ; s.s. *Gladys*, of London, new steamer, docked for sighting, slight repairs ; s.s. *John*, of London, been ashore at Easington, Yorkshire coast, salved and found bottom very much damaged, new plates fitted, and all general repairs done with despatch ; s.s. *Knottingley*, of Goole, been ashore in the river Humber, several new plates, also engine and deck repairs ; s.s. *Grovehurst*, of Sweden, several damaged plates renewed, and general engine and deck repairs ; s.s. *Herm*, of Norway, several damaged plates renewed in bottom and general repairs ; s.s. *Caprera*, of Liverpool, docking, painting, and general engine and deck repairs ; s.s. *Belle of Ireland*, been ashore off Withernsea, salved and towed to Hull to discharge cargo from the Far East, several small repairs done at Hull, after discharging cargo. All Hull dry docks being engaged she could not wait her turn, and hence proceeded to the Tyne.

Humber Iron Works.—Have had a splendid month. On their patent slips they have had several ships undergoing repairs, also several steamer repairs in Victoria and Alexandra Docks, general docking, etc. Their boiler shop is busy with new and repair work.

Messrs. Amos & Smith, Engineers and Boilermakers.—This reputable firm is far from being busy with new work, but seems to keep busy in general repairs and dry dock work.

Messrs. Cooper & Co., Ltd., Engineers and Boilermakers, are keeping fairly busy in the main works at Neptune Street engine shop and moulding shop, especially in propellers for foreign orders ; also busy at their branch shop in dry-docking and general repair work. They keep their own two dry docks at work with coasting steamers, etc.

Messrs. Stewart & Craig, Engineers and Ship Repairers, have had a fairly good month, with general engine and deck repairs and have had in use Alexandra Dry Dock.

The North-East Coast Engineering Works have had the following steamers in hand for general repairs and dry-docking, etc. :—s.s. *Admiral Nelson*, *Edward Dawson*, *Eddie*, *Mauranger* and *Chester*. The firm is under the personal supervision of Mr. E. Clarke. Steamship owners can rely on quick despatch.

Messrs. Woodhall & Co., Engineers, are keeping fairly busy with their Patent Handibloc (see illustration, page xxi.), and also their Chain Testing Hydraulic Machine. They have had several repairs on a number of coasting steamers in the Princes Dock.

Messrs. Cochrane & Co., Shipbuilders, Selby.—The firm is short of fresh orders for building at present. An exciting incident occurred on 15th January. There was a large attendance at the launch of a steam trawler for a Grimsby owner. The vessel—which had been christened by Mrs. Horne, wife of Mr. Fred Horne, the Liberal candidate for Barkston Ash—dropped broadside on into the Ouse. There was a tremendous splash, and the backwash was so strong that it descended in great waves on to the East Riding embankment and on to the pathway, greatly alarming the spectators, who beat a hasty retreat.

Messrs. Cook, Welton & Gemmell, Shipbuilders, Beverley, have secured the order from C. Hellyer & Co., Hull, to build two fleeters, to Lloyd's requirements ; also two trawlers, for Mr. Sleight, of Grimsby, for North Sea and Iceland fishing. The boats are to be up to date and to pass Lloyd's rules.

THAMES.

(From our Own Correspondent.)

The New "Dreadnought."—The placing of the contract for the battleship to be built on this river has not been without its peculiar incidents, in fact, whether it is more than provisional is now not quite clear. As the Company has, however, complied with the conditions laid down we may assume there can be no hitch in the negotiations. (The provisional order has now been confirmed—Ed. *M. E. & N. A.*) The Company had to furnish a guarantee of £80,000 for the due completion of the work, and had to be furnished with funds to carry out such a large contract, and for this purpose meetings of second debenture and preference shareholders were necessary, and at the former the requisite majority was secured. The effect is to increase the working capital of the Company by £100,000. The firm has given provisional orders for materials and is, therefore, prepared in every way to proceed with the building. Two thousand extra hands will be required and the wages paid about £3000 a week. The slip on which the ship will be built will be lengthened 80 ft., and it is expected the vessel will be launched early next year. She will be 19,000 tons and driven by turbines giving 22,000 H.P., with a speed of 22 knots ; delivery to be by March 31st, 1912, fully ready for commission. While the hull will be built at Blackwall the engines will be constructed at Greenwich, and after launching suitable arrangements have to be made for fitting out on the river. The work entails considerable satisfaction to the East End trading interests particularly, while the South-Eastern portion of London will share in a lesser degree in the good fortune that has been so long absent in this department, and which is said to be but a precursor of further contracts.

Shipping Companies.—The P. & O. Co. have ordered two new boats of the improved M type, one to be built by Messrs. Harland & Wolff and the other by Messrs. Caird & Co. They will be nearly 13,000 tons register, and will be employed in the India, China and Australian services. The Co.'s tonnage under this designation will now be raised to ten ships aggregating about 100,000 tons. The Shaw Savill & Albion Co. have just had launched at Belfast the *Rangatira*, of 500 ft. length and 8200 tons, which vessel will have London as her home port. She has been specially designed for the service between London and New Zealand. The Zeeland Co. have lately had built by the Fairfield Co. three vessels named the *Mecklenburg*, the *Prinses Juliana* and the *Oranje Nassau*, and they will shortly be running on the Queenborough-Flushing route. These are all twin-screw steamers.

The Port of London Authority.—Some of the members and officials of this new body have paid a visit of inspection to Liverpool to view the shipping facilities of the Mersey. The question of central office accommodation is before the authority at the present time, and a site belonging to the authority in Crutched-Friars is under consideration for the purpose, it is understood. The schedule of rates for goods imported and exported has been prepared and forwarded to the Board of Trade, and conferences have taken place with the traders themselves where necessary. Generally the rates are in accordance with the value of the goods. The Board of Trade will then issue a Provisional Order and opportunity will be given for persons interested to express their views. Meanwhile barge and tug owners have grievances of charges against the authority and have presented a petition of protest to the head manager of the docks, Mr. Watts, who has promised redress where the Board consider such necessary.

The Millwall Docks Co.—What is really the final distribution by this Company has been proposed in general meeting, and it was for three months working only. There has been some dispute with the Port Authority regarding previous balance, but this amount has been compromised. Out of the £2903 available 11s. per cent. was recommended to be paid on the 5 per cent. pref. stock. The docks are handed over to the authority in good condition, the chairman said. With the above distribution steps will be taken for a final dissolution of the Company in due course.

The Seamen's Hospital.—The Duke of Marlborough, the

president of this institution, recently unveiled a tablet erected in one of the wards over a bed which Lady McIlwraith has endowed with a donation of £1000. The number of seamen treated by this institution has grown within thirty years from 3000 to 30,000, a very notable increase. The hospital has, however, the School of Tropical Medicine attached to it, and is therefore unique in this respect, and for seamen valuable accordingly.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(*From our Own Correspondent.*)

Messrs. Summers & Payne, Ltd., Belvidere, Northam.—This firm are fitting out the s.y. *Sheelah*—owner, Mr. James Ross—for a cruise in the Mediterranean, and she was dry-docked last month for painting, etc. The s.y. *Catania*, R.Y.S.—owner, the Duke of Sutherland—has also been undergoing a refit and left last month for Nice, where his Grace will join her for a short cruise. The s.y. *Invincible*—owner, the Hon. H. G. Squiers, is also being fitted out at the yard. The s.y. *Zenaida*, R.Y.S., is undergoing Lloyd's No. 3 Survey, and it is anticipated that she will go into commission on Charter. Thirteen yachts have already left or are under orders for the Mediterranean. This is an unusually large number for this period of the year. There are signs of a great yachting boom in the States this year, and many of the yachts will be visiting Europe.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works.—H.M.S. *Savage*.—The condensers were shipped last month and the deck closed up, and the fitting of the launch-ways and cradles was completed, and the launching ceremony is to take place about the middle of this month. H.M.S.'s *Larne, Lyra, Martin* and *Minstrel*.—Good progress is being made with the framing of these vessels, the first two being completed last month. Shallow draught tug for Russia.—The boilers were shipped last month, and the funnel erected in place; good progress is being made with the general fitting up, and the launching ways are being laid. Mine-laying and torpedo base vessel for Portugal.—This vessel is now well advanced, and the masts, derricks and rigging are completed. She is to be named *Vulcano*, and it is expected that she will be launched early this month. Motor launches.—Good progress was made during last month with the motor launches under construction; one has already run her trials, and another was almost ready for trials at the end of last month. An order was booked last month for a tunnel screw motor boat for the Crown Agents for the Colonies. The following are the principal dimensions of the boat, which is intended for service on the Pahang River. Length, 56 ft.; beam, 9 ft.; draught, 15 ins. This vessel will be similar in many respects to the Thornycroft-built *Spider*, but is to be fitted with much more powerful motors. Repair work.—A large amount of repair work was carried out during last month on various transports, yachts and other vessels.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

A Busy Year for Vickers.—There is nothing in the shape of any important development to chronicle this month, and we in this district are still in the dark about the two colonial warships to be built by private yards. Orders, we were told a month ago, were to be given out for the Australian battle-ship-cruiser and the New Zealand "Dreadnought," but up to the present there has not been a whisper about them. One will have to wait for the new Government before one hears anything.

There can be no doubt as to the position of the firm of Messrs. Vickers now. The payments by the Admiralty to this firm are the highest of any and their warship tonnage is also above any other yard. The firm never entered upon a year which had such prospects of work. On the ship-building side—the weakest of all departments—there is the two floating docks, the second-class cruiser which is to be called the *Dartmouth*, and the huge battleship-cruiser. Of the latter ship many statements have been made as to its name, and *Princess Royal* is mentioned. Such a name as that, welcome as it would be, seems out of place with the others, *Lion, Orion, Thunderer*, etc. Still, if it is *Princess Royal* it may mean Royalty at the launch, and Barrow dearly longs for such a thing. The engineering shops will be tremendously busy. The construction of the machinery and boilers for the *Lion* and the Barrow battleship-cruiser will soon be commenced. That means forty-two boilers for each vessel, some with three and some four furnaces, or a total of about 150 furnaces for each. While the boiler shops are busy on these the engineering shops will be at work on the two sets of turbines of 70,000 i.h.p. each. This will mean a tremendous rush of work. Then as for the gun-mounting department they have work for several years. Altogether, Barrow has every reason to be heartily thankful that Messrs. Vickers cast their eye upon the town. It has meant much to the industrial centre and has resulted in considerable development of the borough.

"Dreadnought" Floating Dock.—The Furness Railway Co. some time ago issued a map of the Barrow Docks and adjoining land, on which was a portion coloured which said "proposed floating dock." This seems to be about as far as the scheme has got. There can be no two opinions as to the necessity of such a dock, but the cost would be very considerable, and I don't think the Government are much inclined to subsidise the builders. Unfortunately, the Barrow Docks are situated upon peculiar ground, and recent engineering work has proved the existence below surface of running sand, and this, of course, means enormous expense in obtaining foundation. The difficulty would arise practically anywhere near the docks, hence the cost of construction would be considerably augmented. On the other hand, deep dredging would be only necessary for a floating dock which would cost over £200,000; no doubt great depth would be necessary. Still a dock is needed, and with such a firm as Messrs. Vickers is bound to come sooner or later.

The "Dreadnoughts."—The two "Dreadnoughts," *Vanguard* and *Sao Paulo*, are still at the Buccleuch Wharf, the former almost ready and the latter gradually nearing completion. The date of the *Vanguard's* departure is not fixed, and the same remark applies to the date of the departure of the Brazilian for her trials. There does not seem to be much hurry about the latter.

The Brazilian Order.—For some time the news has been travelling about that Messrs. Armstrongs have begun work upon the third Brazilian "Dreadnought" *Rio Janeiro*. That being so, Messrs. Vickers would have commenced work upon the machinery for that vessel, but it is not so. There may be any amount of truth in the statement that Brazil requires three, but it is possible that some time will elapse before work is actually commenced upon the third. "Dreadnoughts" cost a lot of money.

Changes at Messrs. Vickers.—Mr. James Glen, who for some time has been the works manager at Messrs. Vickers, since the departure of Mr. Campbell for Ferrol in Spain, prior to which he was assistant to that gentleman, has left Barrow to join Mr. Gowan as assistant at Palmer's works at Jarrow. Mr. Glen was the recipient of some handsome presents the other evening. Mr. Hamilton, of the outside staff of Messrs. Vickers, has left the firm, but will stay in Barrow. He will be consulting engineer for several local shipping companies, including the Midland express steamers, which run from Barrow and Heysham to Irish ports and the Isle of Man. This gentleman, too, has received some handsome presents, both from the workmen and the staffs. The important post of works manager is now vacant, and it will be very important considering that the battleship-cruiser work is coming on. Several names have been mentioned, but no appointment has been made yet.

The Spanish Contract.—For some reason—and a proper one, no doubt—the utmost secrecy is observed regarding the Spanish contract. Much as Barrow is interested in this huge business the contract might not be existent, so silent is everybody about it. That it is proceeding all right we know, but beyond that nothing is known except that more British workers have been required owing to the inability of the Spaniard to come up to a satisfactory standard as regards ability.

Hæmatites.—The hæmatite iron market has become very buoyant and greater business is being done at enhanced

prices. The warrant market has more confidence, and warrant stores are jumping up considerably. Japan (Admiralty) are again customers for pig iron, and 2000 tons left during the month in one of Holt's big Japanese trading steamers. The steel trade continues about the same, but one hears rumours of orders for plates again going to the Scotch makers and to South Wales—particularly the latter. Barrow has a big plate mill which has been idle for nearly two years now. It seems very remarkable and difficult to understand. The total output of iron last year was approaching 1,500,000 tons, and the iron and steel shipments jumped up over 100,000 as compared with 1908. This year should show great improvement in every way.

BELFAST.

(From our Own Correspondent.)

Work in Progress.—According to Lloyd's Returns for the quarter ended 31st December last, there are fifteen vessels building in Belfast, having an aggregate of 168,210 tons, as against twenty-two, of 196,160 tons, at the corresponding period in 1908.

Messrs. Harland & Wolff.—At the present moment the Queen's Island firm have no new tonnage afloat, but within a few days of writing they will launch from the north end of their yard the fine new Union-Castle liner *Edinburgh Castle*. The repairs and overhaul on the Holland-American liner *Nieuw Amsterdam* were completed a few weeks since, and at present they have a very big repair job in hand on the Royal Mail Steam Packet Company's *Trent*, which was ashore some little time since.

Messrs. Workman, Clark & Co. have four vessels at the fitting-out wharves, and will shortly launch the screw steamer *Tenet*, which they are building for Mr. W. A. Grainger, of Belfast. They have been in negotiation with the Belfast Harbour Commissioners regarding a large plot of land for extension of their shipbuilding yard. The question of rent and other details has already been settled, and the matter now only requires confirmation by the Commissioners. The additional ground is on the County Antrim side of the river, adjoining the firm's north yard. It is understood that slips will be provided for construction of vessels of the largest size.

Harbour Notes.—At the first meeting of the Harbour Commissioners in 1910, the Chairman, Mr. Robert Thompson, J.P., announced that 1909 had been the most prosperous year in the history of the Trust. Not only had the tonnage been the largest, but the receipts in cash had been considerably in advance of any previous year. This is all the more satisfactory in view of the fact that large sums have been expended in various works. The big new graving dock is nearing completion, but there still remains a good deal to be done in connection with the buildings and equipment. It is now expected that the dock will be opened about the middle of the summer.

"Bitumastic" Enamels.—Messrs. Wailes, Dove & Co., Ltd., of Newcastle-on-Tyne, have opened a new branch office at 49, Blackfriars Street, Manchester.

Messrs. Leonard Chapman & Co., Importers and Manufacturers, Munton Road, London, S.E., report:—Graphite, as imported, according to quality:—

Ceylon L.L. c.i.f. London	£21	0	0	to	£45	0	0	per ton
,, O.L. ,,	17	0	0	to	46	0	0	,,
,, chips ,,	14	0	0	to	32	10	0	,,
,, dust ,,	9	10	0	to	25	0	0	,,
Purified, milled and ground.								
Ceylon, 97% to 99%, f.o.b. London	59	0	0	to	63	0	0	per ton,
,, 90% to 91% ,,	40	0	0	to	42	0	0	,,
,, 80% to 81% ,,	30	0	0	to	32	0	0	,,
,, 70% to 71% ,,	27	0	0	to	28	0	0	,,
American large flake, f.o.b. London	45	0	0	to	49	0	0	,,
,, small ,,	35	0	0	to	45	0	0	,,
Graphite Joint Compd. ,,	2	9	0	to	2	12	6	per cwt
Graphite Paint Paste ,,	2	2	0	to	2	5	0	,,
Graphite Paint ,,	0	4	9	to	0	5	3	per gal.

Wholesale list of tinned goods on application

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Bondicar.—On December 23rd, there was launched at Sunderland a steel screw steamer, built to the order of the Broomhill Collieries, Ltd., Newcastle-on-Tyne, for their general trade from Warkworth Harbour. The vessel is designed to carry a deadweight of about 1970 tons on a low draught of water, and will be fitted with triple engines and two boilers of 180 lbs. pressure.

Cantilever Steamer.—On December 27th, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw cargo steamer built on the well-known patent cantilever-frame system with topside water ballast tanks to the order of Messrs. Elder, Dempster and Co., of Liverpool. The vessel is of the shelter-deck type, and will have a deadweight carrying capacity of about 8000 tons on a light draught of water.

Kaduna.—On December 27th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, a steel screw steamer for Messrs. Elder, Dempster & Co., of Liverpool, and of the following dimensions, *viz.*: Length about 375 ft., breadth 50 ft., depth moulded 33 ft. 3 in. and to class 100 A1 at Lloyd's, shelter deck rule and having poop, bridge and forecastle. This vessel has water ballast fitted right fore and aft on the cellular system and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including nine double cylindered steam winches, direct-acting steam windlass, large multitubular donkey boiler, steam-steering gear by Messrs. Rogers & Co., and screw gear aft. The vessel is handsomely fitted up amidships with luxurious state-rooms for 1st-class passengers, and the poop is fitted up for the accommodation of 2nd-class passengers. The forecastle is fitted up for the accommodation of sailors and firemen, having separate bath-rooms and mess-rooms and library. The engines, which are supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend, are of the triple-expansion type, having cylinders 25 in., 40 in. and 68 in. by 48 in. stroke, and working at a pressure of 180 lbs.

Bjornstjerne Bjornsen.—On December 28th, Messrs. William Gray & Co., Ltd., launched the steel screw steamer *Bjornstjerne Bjornsen*, which they have built to the order of Mr. Vilhelm Torkildsen, of Bergen, Norway. She will take the highest class in the British Corporation Register and is of the following dimensions, *viz.*:—Length overall, 422 ft 6 in.; breadth, 54 ft.; and depth, 28 ft. 11 in., with two decks laid, long bridge, poop and topgallant forecastle. The hull is built with deep bulb-angle frames, clear holds, cellular double bottom and large aft and fore peak ballast tanks, ten steam winches, the exhaust steam being carried back to engine-room, steam gear amidships, hand screw gear aft, patent direct steam windlass, shifting boards, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead and ventilation sufficient for the Eastern trade. Electric light and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders having cylinders 25 in., 42 in. and 70 in., with a piston stroke of 48 in. and four steel boilers for a working pressure of 180 lbs. per square inch. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamels were applied to the bunkers, also under sidelights in way of accommodation.

Hodder.—On January 10th, Messrs. William Dobson and Co. launched from their shipbuilding yard at Walker a steel screw steamer which they have built to the order of the Lancashire and Yorkshire Railway Company, for their regular service between Goole and Hamburg. The dimensions of the vessel are—Length between perpendiculars, 240 ft.; beam, 34 ft.; depth moulded, 16 ft. 4 in. The vessel is built with exceptionally fine lines and high power with a view of obtaining a speed of 13 knots on service. The machinery is being built by the Wallsend Slipway and Engineering Co., Ltd., and is of the triple-expansion type, having cylinders 22 in., 36 in., 61 in. by 39 in. stroke, having two large single-ended boilers with Howden's forced draught. The vessel has been specially constructed for the owners' Continental service with the most modern arrangements for loading and

discharging cargo, and will, when completed, form one of the most up-to-date vessels for this service. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the boiler-room and bunkers.

Bradford City.—On January 10th, Messrs. Ropner and Sons, Ltd., Stockton-on-Tees, launched from their shipbuilding yard a steel screw steamer of the following dimensions, *viz.*:—Length, 358 ft. 6 in.; breadth, 50 ft. 10 in.; depth, 25 ft. 6 in. The vessel is built to the highest class in the British Corporation Registry, having main deck, poop, bridge and topgallant forecastle. The vessel has been built to the order of Messrs. W. R. Smith & Son, of Cardiff, and has double bottom for water ballast on the cellular principle and in fore and after peaks. She will be fully equipped with an up-to-date outfit, including quick-warping steamw indlass, stockless anchors, steam-steering gear amidships and powerful screw gear aft. The appliances for loading and discharging cargoes expeditiously are very complete, and include eight steam winches, double derricks to each hatch, steam being supplied by a large donkey boiler working at 100 lbs. pressure per square inch. The engines will be of the triple-expansion type by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Sunderland, of about 1500 I.H.P., having two steel boilers 15 ft. by 9 in. by 10 ft. 6 in., 180 lbs. steam pressure. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the bunkers and boiler-room tank and their "Bitumastic" covering to the tank top in boiler-room.

Scottish Prince.—On January 11th, Messrs. Short Brothers, Ltd., launched from their shipbuilding establishment at Pallion, Sunderland, the screw steamer *Scottish Prince*, built to the order of the Prince Line, Ltd., of Newcastle-on-Tyne. The vessel, which will take Lloyd's highest class, is built on the single-deck principle with bulb-angle deep framing and clear holds, and has a complete shelter deck sheathed with pitch pine and topgallant forecastle. She is 353 ft. 6 in. in length, 46 ft. 4 in. in beam, and 22 ft. 11½ in. depth moulded, and is estimated to carry a deadweight cargo of over 5000 tons on a light draught. Water ballast is provided throughout the double bottom and in both fore and after peaks. Accommodation for twelve passengers is provided in large deck-house on top of shelter deck. Seven steam winches, steam-steering gear amidships, direct steam windlass, etc., are provided, taking steam from a large multitubular boiler of 100lbs. pressure, fitted on shelter deck and exhausting to a winch condenser. Double derricks are provided to each hatch mounted on tables at masts, and in addition a steel derrick, arranged to lift 30 tons and to work from either mast. Special arrangements have been made to dispense with obstructions in holds and 'tween decks, enabling bulky pieces of machinery to be shipped. The propelling machinery is by the North -Eastern Marine Engineering Co., Ltd., of Sunderland, and consists of engines having cylinders 25 in., 41 in., and 69 in. dia., with a stroke of 45 in., driven from two large boilers working at 180 lbs. pressure and fitted with Howden's forced draught. The vessel is expected to make a steady speed at sea of 10½ knots.

Benbrook.—On January 12th, Messrs. Craig, Taylor and Co., Ltd., launched from their Thornaby shipbuilding yard, Stockton-on-Tees, a finely-modelled steel screw steamer to carry about 6800 tons deadweight on a light draught of water. The owners, Messrs. Joseph Hoult & Co., Ltd., of Liverpool, were represented at the launch by Mr. B. Allen, of Liverpool, under whose superintendence the vessel has been built.

Zinovia.—On January 12th, Messrs. William Gray and Co., Ltd., launched the handsome steel screw steamer *Zinovia*, which is the third steamer they have built for Messrs. Michalinos & Co., of London and Piræus. She will take the highest class in Lloyd's, and is of the following dimensions, *viz.*:—Length overall, 342 ft. 6 in.; breadth, 47 ft. 6 in., and depth, 23 ft. 2½ in., with extra long bridge, poop and topgallant forecastle. The hull is built with deep bulb-angle frames, cellular double bottom and large aft and fore peak ballast tanks, six steam winches, steam gearing gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders having cylinders 23½ in., 38 in. and 64 in. dia., with a piston stroke of 42 in. and two large steel boilers for a working pressure of 180 lbs. per square inch.

Ramsgarth.—On January 12th, Messrs. Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyards, Middlesbrough-on-Tees, the fine steel screw cargo steamer *Ramsgarth*, building to the order of Messrs. R. & J. H. Rea, of Liverpool, Cardiff and Southampton, to fulfil the very special requirements of the owners' extensive coal carrying trade. The vessel is being constructed under special survey to class 100 A1 at Lloyds. Her principal dimensions are 252 ft. by 36 ft. 3 in. by 20 ft. 9 in. moulded, and she will have a deadweight carrying capacity of about 2450 tons on a light draught of water. Triple-expansion engines having cylinders 18 in., 30 in. and 50 in. by 36 in. stroke, supplied with steam by two large single-ended boilers working at 180 lbs. pressure, will be fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Middlesbrough. A Cochran (Annan) donkey boiler, fitted with patent seamless furnace, has been supplied.

Cartier.—On January 13th, the twin-screw steamship *Cartier*, intended for the hydrographic service of the Canadian Government, was launched from the Neptune Works of Messrs. Swan, Hunter & Wigham Richardson, Ltd., Walker-on-Tyne. The new vessel is 164 ft. long by 29 ft. beam, and has a depth of 13 ft. She is to have a speed of 11½ knots. It is intended to employ her in completing the hydrographic survey of the east coast of Canada, beginning with the St. Lawrence river.

Steel Screw Steamer.—On January 13th, there was launched from the yard of Messrs. R. Williamson & Son, Workington, a steel screw steamer of the following dimensions:—Length, 140 ft. 6 in.; breadth, 24 ft. 2 in.; depth moulded, 12 ft., and designed to carry about 520 tons deadweight on Lloyd's freeboard. The vessel is built to the highest class at Lloyd's, and will be propelled by compound surface-condensing engines having cylinders 17½ in. and 38 in. diameter, by 27 in. stroke, steam being supplied by a large cylindrical steel boiler 12 ft. 9 in. diameter by 10 ft. long, working at a pressure of 130 lbs. The vessel has been built by the above builders, and if unsold on completion it is their intention to run her in the British coasting trade.

Lois.—On January 15th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely-modelled steel screw trawler, the principal dimensions being 135 ft. by 24 ft. by 13 ft. 2 in. moulded. The vessel has been built to the order of Messrs. The Fleetwood Steam Fishing Co., Ltd., of Fleetwood, and will be fitted with powerful triple-expansion engines by Messrs. Amos & Smith, Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Normandy.—On January 15th, there was launched by Earle's Shipbuilding and Engineering Co., Ltd., Hull, for Mr. Joseph Constant, of London, a finely modelled steamer of the following dimensions:—Length, 250 ft.; breadth, 42 ft. 6 in.; depth, 20 ft. She has been specially constructed of steel, to the British Corporation Registry's classification, to carry a large cargo upon a draught of 10 ft. for the light draught Baltic and White Sea trades, a very special feature being the hatchways with continuous fore and aft coamings extending the longitudinal full length of the main deck, which gives immense strength. The hull is subdivided into seven water-tight compartments, with a capacity of about 600 tons of water ballast. Her cargo gear consists of six derricks and steam winches, all by Clarke, Chapman and Co. She is to be fitted by Earle's Company with a set of their triple-expansion engines of 18 in., 29 in. and 50 in. diameter by 33 in. stroke, and two large main boilers to Board of Trade requirements for a working pressure of 180 lbs., which it is anticipated will give her a mean speed of about 11 knots. Her equipment includes feed-water heater, evaporator and electric lighting throughout.

LAUNCHES Scotch.

Celtic Pride.—On December 28th, a new steel screw cargo steamer, built to the order of Messrs. Alexander Rank, Ltd., Hull and London, was launched at Aberdeen. The vessel, which was named *Celtic Pride*, is of the following dimensions: Length, 155 ft.; breadth, 25 ft.; and depth, moulded,

12 ft. She will be fitted with engines of 490 h.p. The *Celtic Pride*, which will have a carrying capacity of 500 tons, is intended for the grain and flour carrying trade.

Craigewan.—On December 28th, a new steel trawler, built to the order of the Peterhead Steam Trawling Co., Ltd., was launched at Aberdeen. The dimensions of the vessel are:—Length, 117 ft.; breadth, 22 ft.; depth, 13 ft.

Highland Pride.—On December 28th, there was launched at Port Glasgow the shelter-deck steamer *Highland Pride*, of 7200 tons gross, built to the order of Messrs. H. & W. Nelson, Ltd., Liverpool and London. The vessel is of the following dimensions:—Length, 405 ft.; breadth, 56 ft.; depth, 29 ft. 6 in. The engines will have cylinders 31 in., 51 in. and 86 in. in diameter, by 54 in. stroke. The new steamer is a sister ship to the *Highland Rover*, presently fitting out in Greenock. She is fitted up for carrying first and second class passengers, and is insulated throughout for the carrying of frozen meat between Argentine and Liverpool. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering has been applied to the tank top in boiler-room and donkey boiler recess and their "Bitumastic" enamel to the bunkers and boiler-room tanks.

Scapa.—On December 28th, Messrs. Hawthorns & Co., Ltd., shipbuilders, Leith, launched a screw steel whaler to the order of Messrs. Salvesen & Co., Leith. This boat is the first of three that Messrs. Hawthorns are at present building for the same owners. The dimensions are 100 ft. long by 19 ft. beam by 12 ft. deep. These vessels will be fitted by the builders with triple-expansion engines of 400 I.H.P., and with all the latest improvements for whaling purposes, such as powerful four-cylinder steam winch, gun, etc. These vessels are intended for Messrs. Salvesen's whaling station in the South Atlantic.

Luxemburg.—On December 30th, the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, launched a steel screw steamer 235ft. by 36 ft. by 18 ft. 4 in., for the Leith, Hull and Hamburg Steamship Co., Ltd.,—Messrs. James Currie & Co., managers, under the superintendence of Captain Tait, marine superintendent, and Mr. Reid, engineer. Immediately after the launch she was placed in the Company's dock to receive her machinery, which has also been constructed by the builders. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel has been applied to the bilges, tank top in engine-room and bunkers, and their "Bitumastic" covering to the tank top in boiler-room.

Paritutu.—Messrs. Fleming & Ferguson, Ltd., Paisley, have launched the sternwell twin-screw combined bucket and suction dredger *Paritutu*, built to the order of the New Plymouth Harbour Board, New Zealand.

Bradenburg.—The Greenock and Grangemouth Dock Co. have launched from their Grangemouth yard a steel screw steamer built to the order of Messrs. James Currie & Co., of Leith, for their general cargo trade. The vessel's dimensions are:—Length, 235 ft.; breadth, 36 ft.; and depth, 18 ft. 4 in. (moulded). She is built to the highest class at Lloyd's, with raised quarter-deck, bridge and forecastle. A specially large amount of water ballast space has been provided for in double bottom, peaks and deck tanks. The machinery is of the triple-expansion type. The vessel is designed to carry a large deadweight on a light draught with good speed, and she is equipped in a thoroughly up-to-date manner with latest type of windlass, steering gear, winches, etc. She is the first of three similar vessels being built at Grangemouth for the same owners. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel has been applied to the bunkers and bilges fore and aft, and their "Bitumastic" covering to tank top in boiler-room.

Zealandia.—Messrs. John Brown & Co., Ltd., Clydebank, have recently launched the twin-screw steamer *Zealandia*, which they are building for Messrs. Huddart, Parker & Co., Proprietary, Ltd., Melbourne. The vessel will be employed in trading between the various ports round the coast of Australia and the adjacent islands, and will be a valuable addition to the large fleet of vessels owned by Messrs. Huddart, Parker & Co. She has been built under special survey, and will be classed 100 A1 at Lloyd's. She will also be equipped in accordance with the Board of Trade requirements for a foreign-going passenger steamer. Her principal dimensions are:—Length between perpendiculars, 410 ft.; breadth, (moulded), 54 ft. 6 in.; depth to shelter deck, 34 ft.; and of about 6600 tons gross. Accommodation is provided for about 200 first-class passengers, 120 second class, and 126 third class. Besides the extensive passenger accommodation, the vessel is designed to carry a large amount of cargo, and for this purpose four cargo holds are fitted with large hatches to each. The propelling machinery, which is also being constructed at the Clydebank works, consists of two sets of quadruple-expansion engines, on the inverted direct-acting principle, designed for a working pressure of 215 lb. Each set has four cylinders operating four cranks, and arranged on the Yarrow-Schlick and Tweedy system of balancing. Steam is supplied by seven single-ended multitubular boilers, arranged in one boiler-room, and worked under Howden's system of forced draught.

Indradeo.—On January 12th, there was launched on the Clyde by Charles Connell & Co. a large steel screw steamer for the Indra Line, Ltd., Liverpool. The vessel, which has been built to Lloyd's highest class, strengthened, spar deck rule, with cellular double bottom right fore and aft, will be fully equipped with all the most modern appliances. Both hull and machinery have been constructed under the supervision of Messrs. G. S. Goodwin & Co., Liverpool.

Liddesdale.—On January 12th, there was launched at Port Glasgow a cargo-carrying steamer named *Liddesdale*, built to the order of Messrs. Robert M'Kill & Co., Glasgow. She will be towed to Glasgow, where her machinery will be fitted. The new vessel is of 4500 tons gross. Her dimensions are:—Length, 385 ft.; breadth, 51 ft.; depth, 28 ft. 6 in. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering was applied to the tank top in boiler-room, and their "Bitumastic" enamel to the engine and boiler-room tanks, peaks, chain locker and bunkers.

Garth Castle.—On January 13th, the new steamer *Garth Castle*, which is being built by Messrs. Barclay, Curle & Co. Ltd., of Glasgow, to the order of Messrs. Donald Currie & Co., for the Union-Castle Mail Steamship Co., Ltd., was successfully launched at Whiteinch, the christening ceremony being performed by Miss Marjorie Wisely, one of the grand-daughters of the late Sir Donald Currie. This new steamer, like her sister vessel the *Grantully Castle*, which was launched at Whiteinch on the 14th of October, 1909, is for the intermediate service of the Union-Castle Line to South and East Africa. She is a twin-screw steamer, constructed of steel throughout to the highest requirements of Lloyd's and the Board of Trade for foreign-going passenger steamers. Her dimensions are:—Length 466 ft.; breadth, 54 ft. 3 in.; depth, 33 ft. 6 in., while her gross tonnage is about 8000. Accommodation is provided for a large number of first, second and third-class passengers, and is of the highest character, the cabins being fitted mostly with two berths only and furnished in the most luxurious manner. The sanitary accommodation, electric lighting, steam heating, ventilation, etc., have received the most careful consideration, and are all of the latest and most approved description. The vessel generally is a very fine example of a modern passenger steamer of moderate speed, and represents the joint experience gained by the builders and the owners during a business connection extending over many years, during which time the builders have constructed a large number of vessels for Messrs. Donald Currie & Co. The name given to this steamer is that of the ancient castle of Garth on the estate of the same name in Perthshire, which was the Highland home of the late Sir Donald Currie till his death last year. The present steamer is the second of the name, the original R.M.S. *Garth Castle* (3705 tons) having been constructed by Messrs. J. Elder & Co., of Glasgow, in 1880, and having been sold by Messrs. Donald Currie & Co. in 1901. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering was applied to the tank top in boiler-room and their "Bitumastic" enamel to the boiler-room and refrigerating space.

LAUNCH—Irish.

Herald.—On December 29th, there was launched from the Dublin Dockyard Co. a twin-screw patent coal elevator. The vessel has been built by the Dublin Dockyard Co. to the order of the London & N.W. Railway Co., for special service in Holyhead Harbour, where she will be employed for the

purpose of coaling the bunkers of the Company's large fleet of steamers. The *Herald* has been built to the designs and under the patents of the Holland Johnson Syndicate. She is a self-propelled twin-screw steamer and will be capable of herself going alongside the steamers immediately on arrival and replenishing their bunkers. It is calculated that the coaling of each vessel's bunker will only occupy some ten to twenty minutes. The dimensions of the *Herald* are—Length 155 ft.; beam 29 ft. 3 in. and depth 12 ft., and she will be capable of carrying about 450 tons of coal on a moderate draught. The design of the vessel is somewhat unique. On each side of two fore and aft bulkheads, which run practically from end to end of the vessel, forming a well and extending from the vessel's floors to a height of 10 ft. above the deck level, are a series of coal pockets having a total capacity as above. The bottom of these coal pockets is built on a slope so that each pocket empties itself by gravity and without any manual labour whatever through the coal door at the bottom and into the scoop of the coal elevator. The upper edges of the two parallel longitudinal bulkheads have rails fitted and serve as a gantry along which carriages carrying the elevators can travel at will. These carriages, of which there are two in this case, bring their respective elevators opposite each coal pocket in turn, and are propelled along the gantry by means of a steam winch at the vessel's stern, which serves also as a warping winch. The coal elevators themselves consist of double trunks forming a ladder way along which a series of strong and compactly fitted coal buckets are induced to travel by means of a driving pentagon at the top. This pentagon, which is the subject of one of the patents, has a very ingenious driving gear which gives to the buckets the digging or shovelling motion, which has been found necessary to successfully deal with compact masses of coal. The motive power is obtained from small engines placed between the trunk and entirely inside the framework, and if the coal is of a dusty nature the dust can be laid by turning the exhaust steam into the elevator head. Each elevator is complete in itself, and entirely distinct from its neighbour, and is capable of dealing with one to four tons of coal per minute, depending on the speed at which it is worked. By means of a shoot suspended from the elevator head the flow of coal can be directed to any desired point. It is claimed for these patent elevators that they are simple in construction, easy to manipulate, requiring the minimum of manual labour, efficient as diggers, and require but small power to drive them with accompanying economy of steam. The *Herald* will be fitted with the new Porhydrometer enabling the quantity of coal supplied to each vessel to be accurately weighed.

TRIAL TRIPS.

Zacapa.—On December 23rd, this new steamer left Belfast Harbour, and after adjustment of compasses in Carrickfergus Roads proceeded on her speed trials on the measured mile, which were highly successful. See Launches, December.

Gladys.—On December 20th, this vessel was taken for trial at sea on the measured mile, when she made a mean speed of $9\frac{1}{4}$ knots per hour loaded. See Launches, December.

Hargrove.—On January 4th, the handsome steel screw steamer *Hargrove*, built by Messrs. W. Gray & Co., Ltd., for Messrs. Harrison, Tidswell & Co., London, was taken on her trial trip. The vessel and machinery have been constructed under the superintendence of Messrs. C. M. Burls & Partners, and Mr. Wm. Crandell of that firm represented the owners on the trial; Captain Murrell represented the shipbuilders, and Mr. Wm. Reynard the engine builders. After adjustment of compasses the vessel proceeded to the Tyne, where she loads for London. An excellent run was made, the vessel having maintained an average speed of $12\frac{1}{4}$ knots on the run round, and the performance of the machinery being highly satisfactory. See Launches, January.

Rachel.—On January 8th, this handsome steel screw steamer, built by Messrs. Wm. Gray & Co., Ltd., for Mr. T. W. Stephens, of London, had her trial trip. There were on board Mr. T. W. Stehpens, senr., Mr. Stephens, junr., and Mr. John Crookston, senr., under whose superintendence the vessel and her machinery have been built; Mr. James Innes represented Lloyd's Registry, Captain J. E. Murrell the shipbuilders, and Mr. Maurice S. Gibb the engine builders, Captain Nunn being in command. The vessel was taken to the Tyne to load, and on the way round averaged a speed of 11 knots, the performance of ship and machinery being in every way satisfactory. See Launches, January.

Benwood.—On January 11th, the trial trip of the *Benwood*, a sister ship of the *Benbrook*, took place, when a mean speed of about 12 knots was maintained over a six-mile course. See Launches, January.

Minimbah.—Recently the new twin-screw passenger and crago steamer *Minimbah*, built by Messrs. Murdoch & Murray, Port Glasgow, for Colonial owners, ran her trials on the Clyde. On the measured mile the contract speed was easily attained. See Launches, January.

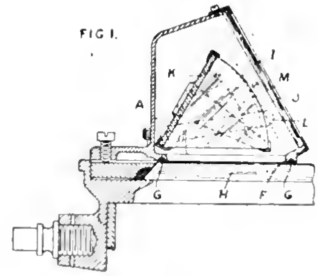
Danae.—On January 15th, the new steamer *Danae*, built by the Sunderland Shipbuilding Co., Ltd., proceeded on her official loaded trial. The principal dimensions are 257 ft. length between perpendiculars, 35 ft. breadth extreme, 17 ft. deep, having raised quarter-deck, bridge and topgallant forecastle, highest class in Bureau Veritas under special survey, and carrying about 2100 tons deadweight upon a light draught. Water ballast is fitted in cellular bottom and peak tanks. The deck machinery consists of four steam winches, steam-steering gear and direct steam windlass. The main engines are by the North-Eastern Marine Engineering Co., Ltd., and have cylinders $19\frac{1}{2}$ in., 32 in. and 53 in. by 36 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch. After proceeding to sea, the vessel made several runs over the measured mile fully loaded, when a mean speed of $10\frac{1}{2}$ knots per hour was obtained; after this a continuous speed trial was run, which gave entire satisfaction to all on board, the necessary revolutions were easily attained without stoppage of any kind. The steamer has been built to the order of Messrs. G. Lamy and Co., of Caen. After the trial she proceeded to Caen.

The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs. E. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

No. 18510. Mariners' Compasses.—An attachment for mariners' compasses to enclose the steering or bearings' prism and protect it, together with the portion of the compass glass below, from deposit of moisture or the like; comprises a casing or hood A having an open or transparent base and an open or transparent side I, the base being adapted through a depending rib F and packing-material G to bear tightly on the outer surface of the compass glass H. Means, such as

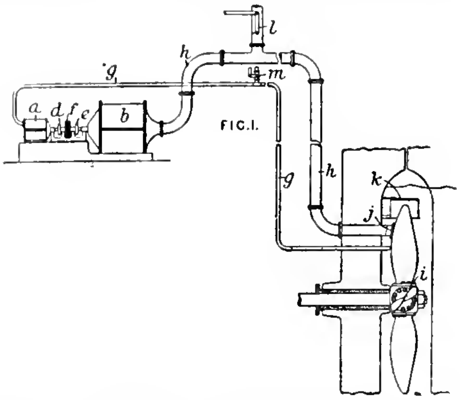
FIG. I.



an arm L engaging with an indented segmental strip M, are provided for angularly adjusting the pivoted prism J from outside the casing. Instead of being pivoted, the prism may be rendered adjustable by having projecting pins on its containing frame K engaging in a curved slot in the casing. In another form the whole attachment is rendered rotatable relatively to the compass bowl. Specifications Nos. 18,300 and 20,185, A.D. 1908, are referred to.

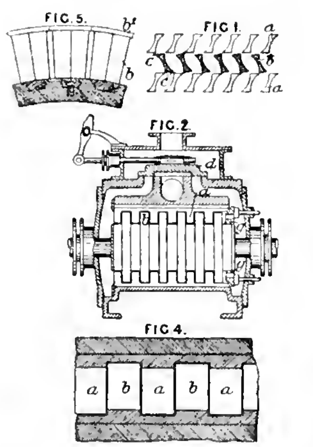
No. 19047. Propelling Ships, etc. To enable internal combustion engines to be used for propelling ships, compressed air or gas is delivered near to the blades of the propeller to increase the slip, and thereby reduce the load on the engine at starting or during rough weather. The turbine

blowers *a*, *b* deliver air by means of the pipes *g*, *h* near to the blades of the propeller *i*. The blowers are driven together or separately through clutches *d*, *e* connected to a convenient source of power by a rope pulley *f*. The supply of air to the propeller may be varied by adjusting the by-pass valves



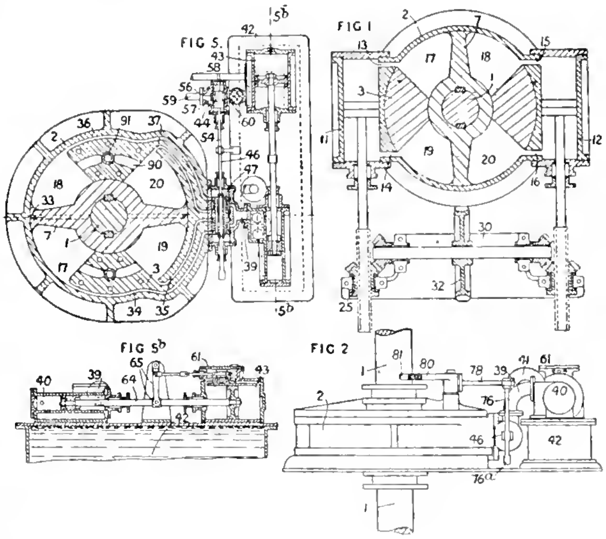
l, *m*. The pipe *g* is used mainly to supply air for regulating the speed of the engine, while the pipe *h* supplies air at a lower pressure chiefly for starting. A shield *k* above the propeller retards the escape of the air, and a flange *j* on the end of the pipe *h* forms a vacuum and assists the exit of the air from the pipe when the vessel is moving forwards.

No. 19332. Turbines.—Relates to reversible turbines having blades with reversely-turned driving-surfaces. The fixed blades *a* and moving blades *b* are equally inclined to the axial direction and are formed with oppositely curved surfaces, which are active or idle according to the direction of flow of the working fluid, which is regulated by the reversing valve *d* and sliding throttle valves *g* provided at each end of the turbine. The rings *g* are provided with orifices to



admit a certain amount of fluid when the rings are at their extreme forward position. To facilitate starting, the edges of the moving blades are cut away as at *c*, Fig. 1. The blade extremities may dip into grooves formed in the rotor and stator, Fig. 4, or they may be fitted with registering flanges b^2, Fig. 5. The blades may be fixed by caulking into grooves formed with transverse slots, Fig. 5.

No. 19980. Ships. Steering Gear.—Relates to ships' steering gear of the class in which the rudder-post has secured to it a vane turned by means of a liquid to which movement is imparted by a pump, etc. The rudder-post (1), Fig. 1, has rigidly secured to it vanes or arms (7) working in a cylindrical casing (2) divided by radial partitions (3) into compartments, into the spaces (17 . . . 20) of which liquid is forced by pumps, etc., to act on the vanes and turn the rudder. Spring-pressed packing-strips (33), Fig. 5, may be provided for the vanes, and the radial walls (3) of the casing (2) may be formed with passages (90) controlled by valve cocks (91) provided with handles. In the form shown in Fig. 1, pump cylinders (11, 12) are provided on opposite sides of the casing (2), the pistons being actuated to force liquid through passages (13 . . . 16), connecting the pump cylinders and the casing (2) by the sleeve nuts (25) rotated by bevel gearing from the shaft (30) with a worm-wheel (32) actuated by hand or power gear. In the form shown in Figs. 2 and 5, liquid is forced by a direct-acting steam-pump (40) from a hydraulic tank (42) through passages (34 . . . 37) in the circumferential wall of the casing (2) into the spaces (17 . . . 20). The spindle (46) of the valve (47), which controls the casing passages and the pipes (39, 41) leading to the pump (40) and the hydraulic tank (42), is connected to and operates the spindle (54) of the steam stop-valve (56) for the steam cylinder (43), which is shown in Fig. 5*b* in a vertical section on the line 5*b*, 5*b*, of Fig. 5. The movement of the valve (56) causes a central groove (57) to register with one of a pair of passages



(58) leading from a steam-pipe (59) and to place the passage in connection with a passage (60) leading from the valve casing (44) to a steam-chest (61) mounted on the steam cylinder (43). The slide-valve of the steam-chest (61) is actuated from a connection (65) to the piston-rod (64). The controlling valve spindle (46) is actuated by a telemotor or other gear connected to the lower end (76*a*) of a lever (76) pivoted to the free end of the spindle (46). Hunting gear for returning the valves to closed position comprises a toothed segment (80) gearing with a toothed segment (81) on the rudder-post (1) and connected by a lever (78) with the pivoted lever (76). In another modification, the liquid for actuating the rudder-post is supplied from an accumulator, control being effected by means of a control valve provided with operating means and hunting gear as in the previous construction.

THE amalgamation of two old-established engineering societies—the Society of Engineers and that of the Civil and Mechanical Engineers—is undoubtedly a step which will be to the advantage of the members of each of the societies, now combined under the title of the Society of Engineers (Incorporated), with Mr. D. A. Symons as the President. The erection of a building for the joint occupation of the various engineering societies in London with club facilities might fittingly form the subject of consideration on the part of the councils or committees of several of the societies whose interests are sufficiently near to one another to be reckoned of kindred moment. A scheme was proposed many years ago with a view to the attainment of an object similar to this, and when we bear in mind the great advantages which would accrue from the establishment of an engineering club in a large central building, with halls, reading-rooms and offices for the engineering societies who have not yet attained suitable premises of their own, we may well say the season is ripe for a consideration of the subject. The Institute of Marine Engineers has had the question of premises under consideration, and there are other societies in the same position.

The Marine Engineer
And Naval Architect.
LONDON, MARCH 1st, 1910.

PROPELLER DESIGN *versus* MANUFACTURE.

THE problems which surround—and obscure!—the truth as to the most suitable proportions for screw propellers, and the conditions under which the maximum of efficiency can be obtained, are still difficult of ordinary solution; but those who are closely engaged in the designing of high-speed vessels, and who have the facilities for research provided by experimental tanks and access to the accurate records now obtainable from the use of torsion meters, are of opinion that we are now approaching the maximum efficiency obtainable from the screw as a propeller under the circumstances in which it is generally used. What is of more importance, it is now possible to predict with much more precision the best dimensions and form for good results. Considering the many cases of important results from the substitution of a propeller of given design and material for one of the same design but of another material, an important aspect of the question presents itself which often fails to receive the attention it deserves. A tabular number of cases of ships fitted with propellers of the special metal of one well-known firm, in replacement of propellers of ordinary cast iron, is before us. The list embraces about thirty vessels, ranging in power from 5,400 i.h.p. to 650 i.h.p., and the increase of speed following the substitution averages half a knot, in some cases the increase being ¾, ⅞ and even one full knot. It may well be asked how it is possible to obtain such results at the present day, when theories of design and construction of propellers are so much better known than some twenty years ago. It may very naturally be assumed that the mere change of material from cast iron or steel to bronze cannot count under ordinary circumstances for more than ⅜ to ½ knot increase in speed on the same consumption. An important factor in the case is that the knowledge of propeller design and construction is much less general and thorough than is frequently assumed. Quite apart from this, however, the striking results frequently obtained by those founders who use a special metal in which they are interested are due to the great care they exercise in manufacture to secure accuracy to drawing, whilst founders of cast-iron propellers frequently appear to have little or no feeling of responsibility on this score. A well-known superintendent-engineer has recently been the victim of two very glaring instances of such carelessness, and we are empowered to publish his experience. In the first case he ordered a cast iron propeller to be 17 ft. 9 in. in diameter and 18 ft. 9 in. pitch. Unfortunately the ship left without the dimensions of this propeller being properly checked. The propeller did not do good service. It was removed and then carefully measured, with the following results:—The diameter, instead of 17 ft. 9 in., was found to be 17 ft. 6 in. The pitches showed the following variations:—Blade No. 1, 18 ft. 6½ in.; No. 2, 18 ft. 8½ in.; No. 3, 18 ft. 0½ in.; No. 4, 19 ft. 4½ in.; average, say 18 ft. 8 in. In the second case a cast-iron propeller was ordered with a pitch of 17 ft. 9 in., but the casting on measurement proved to be as follows: Blade, No. 1, 17 ft. 6 in.; No. 2, 17 ft. 1 in.; No. 3, 17 ft. 1 in.; No. 4, 17 ft. 1 in.; average, 17 ft. 2¼ in. instead of 17 ft. 9 in. We hear of other variations with pitch of cast-iron propellers up to 18 in., and from blade to blade. So long as cast-iron founders work in this manner, and so long as shipowners are content to receive castings of this class, founders of special metal propellers who exercise every care in designing propellers—or in giving accurate effect to a designer's figures and requirements—may be said to be given greater chances of highly successful results than perhaps they sometimes deserve.

PORT OF SOUTHAMPTON

MUCH speculation has been rife for years past as to the ultimate development of Southampton as a port, and as to the controlling factors which will ultimately decide the matter. The half-yearly meeting of the London and South-Western Railway Company afforded an opportunity for a statement by the chairman, Sir Charles Scotter, as to the traffic at Southampton. From his remarks we judge there has been a satisfactory revival of the emigrant traffic to America through Southampton, while a considerable increase in business has been effected with regard to Southampton Docks, very largely due to the improvements of imports and exports in the South American and South African trade. It will be remembered that the White Star Line recently made an application to the local authorities for a deeper channel between the docks and Calshot Castle, so that at low spring tides a channel of not less than thirty-five feet depth shall be available. We are given to understand that there is a division of opinion amongst the members of the Harbour Board as to the necessity of this work, some maintaining that owing to the double tides at Southampton and the rapid rise in the tide there would only be small delay for a few times during the year should ships arrive at dead low water. Other members of the Board argued very strongly that every step should be taken to avoid any possible delay whatever. It is interesting that while this matter is under warm discussion Sir William White, in giving an address to the members of the Engineering Society associated with the Hartley University College, is usefully directing attention to the fact that if the position of Southampton is to be maintained as

a port of call of importance the development must proceed and a greater depth of water be provided, in conformity with the policy adopted in other ports of the world. Sir William made the point very incisive by stating, what every man interested in shipping thoroughly appreciates, that a greater depth of channel is of the highest importance, because the shipowner is enabled to load his ship to an increased depth, and in this way the ship is made more remunerative owing to a small increase in the depth of the water at the terminal port. It is easily conceivable that without such extra depth a ship might be run at little or no profit. We hope the authorities of Southampton will have sufficient sound common sense and prevision to appreciate the necessity of improving the facilities at their port without unnecessary delay, and probably at moderate expense, and thus prevent enterprise being started in another direction and of a competitive character. It must be remembered that Southampton has great natural advantages which are not possessed by other ports geographically situated in as advantageous a position, and it is the clear duty of the Harbour Board to develop those natural advantages for the benefit of the shipping community in general and for the port of Southampton in particular.

JAPAN-BRITISH EXHIBITION.—A Banquet in connection with the forthcoming Exhibition, to be opened at Shepherd's Bush in May, was held in the Hotel Cecil on Monday evening, February 14th, presided over by the Duke of Norfolk. There was a large and influential assembly; the guests of the evening were the Japanese Ambassador and the Commissioner-General of the Japanese Government. The proceedings were characterized by great enthusiasm, and the speeches revealed forces at work which bespeak for the White City a great success during the coming summer as a resort for visitors from near and far. The Chairman—President of the Exhibition—proposed the health of His Excellency the Japanese Ambassador and referred to the close relations between the island Empires of Britain and Japan. These relations would be strengthened and cemented by the proposed Exhibition, in which the peoples of both nations were interested, and taking each a part in bringing to a successful issue. The Japanese Ambassador, who was heartily received on rising to reply, said the relations established about fifty years ago had been growing most cordially and were now all that could be desired. The Japanese Government was promoting the success of the Exhibition, contributing to the exhibits, and the whole nation was backing up the efforts made, so that the results would be very important in promoting the friendly relationship already established. The Lord Mayor of London proposed the toast of "The Commissioner General"—Mr. H. Wada—emphasizing the desirability of adding to the friendly feelings existing between Japan and Britain, extended a hearty welcome to Mr. Wada, a welcome which was endorsed in short speeches by Mr. McKinnon Wood, Sir Melville Beachcroft, Mr. Imre Kiralfy, Mr. Walter Fowler and Sir Boverton Redwood. The Commissioner-General in response said that the enthusiastic spirit with which his Government and people had entertained the idea of such an exhibition as they were looking forward to, was very great. The manufacturers and institutions were all interested, and the display would not only be large, but on a scale and plan quite different from any that had formerly been held. There were so many notable men present at the Banquet that we cannot name all, but among the many we were pleased to see Sir John Durston looking well and beside him Sir Marcus Samuel, Sheriffs Bell and Slasenger.

U.S. BATTLESHIPS "DELAWARE" AND "NORTH DAKOTA."

Of the four ships of the "Delaware" class under construction, two, the *Delaware* and *North Dakota*, have completed their trials and will be shortly in commission. The *Utah* and *Florida* are about 50 per cent. built, and although differing in some details, may be classed with the former ships for all practical purposes.

In design they are merely enlarged "Michigans," with a couple more 12-inch guns and a heavier secondary battery, and present the same peculiar characteristics which made the "Michigans" such interesting ships from a tactical point of view, namely, the mounting of all the heavy guns along the centre-line, so that the maximum broadside fire can be obtained with a corresponding diminution of the bow and stern fire. It will be remembered that in our own ships of the "Dreadnought" era, the ten guns have always been disposed so that eight have bearing on either beam and six both ahead and astern; in the U.S. ships, however, the axial concentration is but four guns fore and aft, while ten have full broadside arcs of training. In short, while we place some weight upon the necessity for retaining a heavy volume of fire for pursuing or retreating actions, the Americans have designed their ships with the sole idea of broadside attack, as the super-firing of the raised guns over the fore and aftermost—although attended without any actual damage to the gun-numbers of these latter—is not likely to be practicable for extended periods owing to the continual blast effects which must of necessity produce a demoralizing effect in time.

The exact disposition of the five twin turrets may be seen from the illustrations herewith. It will be noticed that they are carried on three different levels, those forward being upon the raised forecastle, those aft upon the upper deck, the highest pair having a command of about 36 feet at normal draught. The effect of such excessive mesial line weight upon the stability of the ship in rough weather remains to be seen, but in all probability it will lead to a greater degree of rolling than is consistent with accurate gunnery.

In the *Utah* and *Florida* the three after turrets have been differently arranged, the third being lowered to the upper deck, and the fourth raised to fire over the fifth. By this means the interception of training between the fourth and fifth is overcome, and a slightly increased arc of fire permitted to all three turrets. The suggestion made during the Newport Conference, that the turrets should be placed diagonally and so augment the fire astern, was not adopted.

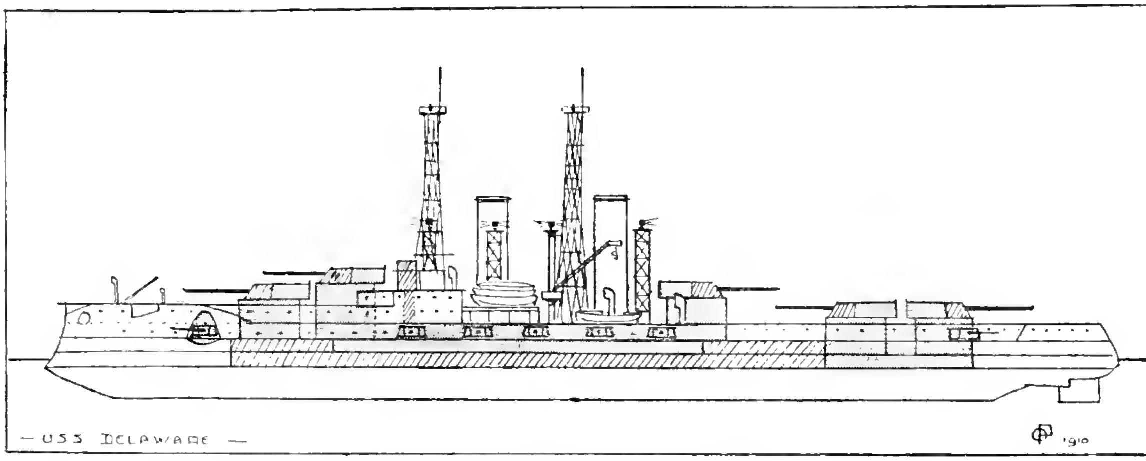
Another feature of the "Delaware" class is the resuscitation of the 5-inch gun for the secondary battery, after its last appearance in the 1898 *Kearsarge* and *Kentucky*. An increase in calibre to 6 inch, 7 inch and 8 inch for the secondary weapons, from the "Alabama" to the "New Hampshire" types, was followed by the abolition of all secondary guns in the *Michigan*, only the 3-inch tertiary anti-t.b. being retained. Now we again see the 5-inch re-appear, which shows that the example set in the "Dreadnoughts" of only retaining 12-pounders (and in later English ships 4 inch guns) was followed, but quickly abandoned. That guns of a greater calibre than 4 inch or even 4·7 inch are an absolute necessity for the destruction of the modern destroyer we have continually urged in these columns for the last few years, and although official details of the armament of our latest ships of the "Hercules" type are lacking, there is good ground for assigning them a 6 inch secondary armament.

The only fault to find with the *Delaware's* 5 inch battery is in the obsolete method of disposing the guns along the main deck, where their usefulness is going to be considerably impaired owing to limited command above the water. True the German *Nassau's* and other "Dreadnought" designs have their secondary guns so arranged, but this in no way disposes of the argument that such guns should be carried at the greatest possible elevation, and it is for this reason that the British ships carry their small guns high up in the superstructure or on top of their turrets. By all accounts, service opinion counts a 4-inch gun so mounted as equal, for anti-t.b. purposes, to the German main deck 5·9 inch gun. It was at one time on the tapis to mount the *Delaware's* 5 inch guns on the turret-tops, but questions of ammunition supply and the like are said to have led to the rejection of the idea.

As it is, only two guns have axial fire, and as it is the aim of torpedo craft to make their retreat along the line on which the least possible number of guns can be trained, the *Delaware* does not seem particularly well fitted to deal with attacks directed or retreats effected from ahead and astern.

The rig can only be described as the most eccentric and original that has ever been put into a warship. All searchlights are mounted on top of miniature Eiffel towers, while huge basket-work structures carry the range-control tops. These are made of steel 3 inch hollow tubes wound spirally, making an elongated cone 10 feet in diameter at the top and 25 feet at the base. From experiments conducted against a similar mast on the old monitor *Florida*, it seemed impossible to bring such erections down with ordinary small shell, as even a few of the tubes were sufficient to support the platforms. Our tripods look very much heavier, and unless the vibration in the "basket" masts is more noticeable than in other patterns, there does not seem much to say against their adoption in our own Navy. That tripods are lighter than their appearance would suggest is, of course, obvious, as their struts are hollow and made of thin steel, but for all that it is a moot point whether they would stand if the centre leg was shot away, although in theory each leg is capable of sustaining the tops.

On trial both ships have done well, and as the *Note*



Plan of the U S Battleship *Delaware*

COMPARATIVE TABLE.

Nation	Ship.	Date of launch	No. in Class.	Displacement in Tons.	Designed I.H.P.	Designed Speed.	Armament.	Torpedo Tubes.	Armour in Inches A	B	C	D
Great Britain	"Vanguard"*	1909	3	19,250	24,500	21	10—12" 20—4"	3	9¾	2¾	9¾	11—8
U.S.A. ..	"Delaware"	1908	4	20,000	25,000	21	10—12" 14—5"	2	11	3	10—5	12—8
Japan ..	"Aki"	1907	2	19,800	25,000	20.5	4—12" 12—10" 12—6"	5	9	3	8	12—8
France	"Danton"	1909	6	18,027	22,500	19	4—12" 12—9.2" 24 Small	2	10	3	8—7	12—9
Germany ..	"Nassau"	1908	4	18,204	20,000	19.5	12—11" 12—5.9" 16—3.4"	6	11—4	4	8	11
Brazil .	"Minas Geraes"	1908	3	19,200	24,500	21	12—12" 22—4.7"	4	9	2½	[illegible]	[illegible]

A = Belt. B = Protective deck. C = Lower deck side. D = Big guns.

*Has specially constructed armour of exceptional resisting power.

Dakota has Curtis turbines and the *Delaware* is fitted with reciprocating engines, the figures put up by each ship have been watched with great interest. Briefly, the *Dakota* put up the highest speed, beating her sister by ·39 knots, and developing 5,000 H.P. more when running at the maximum of 22·25 knots. Economically she is also the better ship, even to as low a figure as 12 knots.

The following are the official figures of the *Delaware's* trials:—

Speed, 21·56 with 28,578 H.P.
Coal used per hour, 53,945 lbs.
Water for all purposes, 14·8 lbs. per I.H.P.
Water for main engines only, 13·42 lbs. per I.H.P.

Her Babcock & Wilcox boilers furnished abundant steam and came up to all requirements.

In the following table a comparison is made between the *Delaware* and contemporary ships.

Extra details for *Delaware* class:—

Length, 510 ft.; beam, $83\frac{1}{4}$ ft.; mean draught, $27\frac{1}{4}$ ft.
Full load displacement, 22,075 tons.
Machinery, *Delaware*, two sets triple expansion two screws.
Rest, Curtis turbines.
Boilers, Babcock & Wilcox.
Coal, 1,016 normal, 2,040 max.
Armour, main belt 8 ft. wide, $6\frac{3}{4}$ ft. below w.l. at full load.
Constructed at Newport News, Delaware.
Fore River Co., N. Dakota.

THE WORKMEN'S COMPENSATION ACT.—The Workmen's Compensation Act is one which, although probably framed with the best intentions by those responsible for it, manifestly requires careful reconsideration and revision by practical business men. Since it came into force this Act has done injury to those it was calculated to serve and protect, while it has played into the hands of the unscrupulous, besides tending to weaken the moral stamina of many who have been preyed upon to their own undoing. A class of professionals has been created, whose methods are not characterized by either justice or mercy, and our law courts have revealed this even to the most casual observer. The tendency of the Act has been, in some respects, to demoralize many who have come within its influence. The tendency of such an Act ought to be in the direction of making the good in the community better, of deterring the evil disposed from inhuman actions, and teach them the better way of life, to indeed be, as all law should be, a terror to evil-doers and a praise to them that do well. This act cannot be so characterised.

INTERNATIONAL CONGRESS OF REFRIGERATION AT VIENNA.—The Second Congrès International du Froid will be held at Vienna in October next, from the 6th to the 12th, before the close of the International Sporting Exhibition and the University has been lent for the meetings. Briefly, the subjects to be discussed are the science of cold; the industrial production of cold; the application of cold to alimentation and to other industries; transport; and legislation. The First Congress held at the Sorbonne in Paris, was attended by some thousands of delegates, including official representatives of forty-three different states and nearly 100 persons from England, and success seems already secured for the Second Congress at Vienna. His Imperial Royal Highness the Archduke Leopold Salvator at the request of the Emperor of Austria, is acting as patron of the Congress, and receptions will be given to the delegates by the Court, and by the Towns of Vienna, Budapest, etc. A representative and influential British Committee is now in course of formation, and the British Colonies are giving their support. Any of our readers who may care to submit a paper, or to attend the Congress, are invited to communicate with R. M. Leonard, *Hon. Secretary to the United Kingdom*, at 3 Oxford Court, Cannon Street, London E.C. Papers must be submitted to the Association International du Froid through the British Committee. Full particulars will be sent to any inquirer.

MODERN SHIPYARD MACHINERY AND EQUIPMENT.

II.

Power Generation and Transmission.

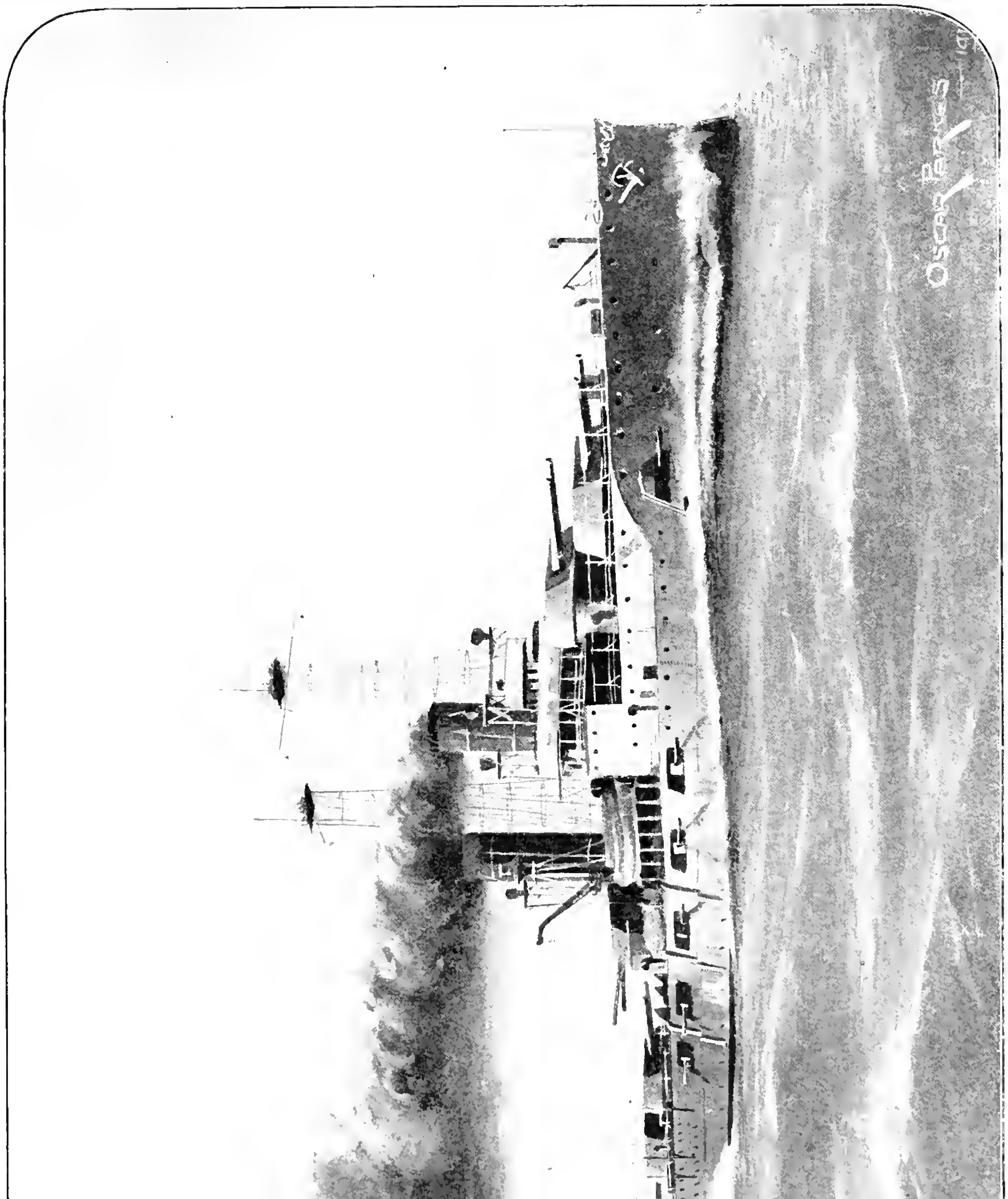
(*Continued from page 202.*)

CONTINUING to treat, in a general way, of the several power systems which are so vital a feature in every up-to-date and many-tooled shipyard, and departing meantime from the line of comment concerned with private power generation, within the works which are to utilize said power (of Messrs. Harland & Wolff's works at Belfast, we had occasion, in this respect, to treat fully and appreciatively in the January issue), it lies naturally to our hand to deal, also very generally, with the subject as concerned with works which prefer to purchase their power from specially established public supply stations.

Given a reasonable price per unit, the main advantages of works taking current from a public supply company's generating station over generating electricity privately, may be briefly summarized:—In the forefront is the consideration of minimum capital outlay. The capital ordinarily expended on generating plant can be used to more advantage on the development of business and plant more particularly appertaining to shipbuilding. On account of the possible heavy requirements for short periods, a shipyard requires, as a rule, an extra large amount of generating plant. With current supplied from outside, no standby or duplicate equipment is absolutely necessary, and there is consequent minimum depreciation. No attendant labour and upkeep being necessary during strikes, holidays and week-ends, the charges thus saved lower the total working cost to yards so equipped per ton of output. This is a great saving in running cost for repair work, night shifts and any work involving the running of part only of the yard plant, it being, in this event, only necessary to run the particular motor or motors required for the special work in hand. Power equal to maximum requirements is by the supply system available night and day, also Sundays, without any special arrangements for starting-up requiring to be made. In the event of a breakdown the supply company can generally furnish a suitable standard motor on temporary loan. The cost of operating any shipyard department can more easily be accurately known and allocated, and in the event of removal or shutdown of yard, any loss is minimised, because standard motors have always a ready market in comparison with special individual electrical, gas or steam plants.

Given, therefore, a condition of affairs where no great immediate advantage lies with a system partially already adopted, or with special local circumstances, it is in our opinion better to be dependent—for moderate-sized yards especially—on public supply. Any of the larger power supply companies established on the banks of rivers like the Clyde and Tyne should be able to quote terms to compete, in the matter of cost, with a private generating station working on an ordinary shipyard load.

Apart from this, however, and assuming that for a normal year's working for all practical purposes there is nothing to choose between the costs of the two systems, some of the principal points in favour of the shipbuilding works purchasing their power from an outside source are given above and may be further emphasized. The shipbuilding firm is relieved of having to provide capital for the generating station; the money which in this way is saved could be more profitably spent in the works themselves by improving or adding to existing machinery. Any extensions to the machine driving plant in the works can be made without consideration having to be given to the capacity of the generating station. Important savings in cost can be effected during slack times; there being no charges due to generating plant, such as attendance, etc. This point also applies in the event of overtime having to be worked, as is frequently necessary, in any small section of the works where power is required. Convenience during periods of abnormally brisk trade and the avoidance of having to provide extra generating plant to meet a temporary excess of load. The power company would in all probability provide duplicate supply mains into the works and would at all times have ample



The U.S. Battleship "Delaware."

spare generating plant available, thus tending to greater security of supply. The consumer, by taking his supply from the mains of a power company, is probably in a better position to obtain the benefits of any improvements in the cost of production than he would be if committed to heavy capital on his own generating station.

Referring to the Clyde, the following shipyards are at present wholly supplied with their power and lighting requirements from the Clyde Valley Electrical Power Company at Yoker, *viz*:—Messrs. Yarrow & Co., Ltd., Scotstoun, 2000 h.p.; Messrs. Simons & Co., Ltd., Renfrew, 1500 h.p.; Clyde Trust Workshops, Renfrew, 550 h.p.; Messrs. Napier and Miller, Ltd., Old Kilpatrick, 800 h.p.; Messrs. Scott and Sons, Bowling, 130 h.p. Within a short period also a further yard at Renfrew with about 1500 h.p. is expected to be completely changed over. The company in addition partially supply (about 500 h.p.) to Messrs. William Beardmore & Co., Ltd., Dalmuir, who, as may generally be known, committed themselves to not only generation by gas engines but to providing the necessary gas for engines of the Ochilhauser type on the Mond-Duff principle.

As illustrating the manner in which the Clyde Valley Power Co. deals with the supply to works in the near vicinity, it may be mentioned that the up-to-date establishment of Messrs. Yarrow & Co. at Scotstoun is supplied with three-phase alternating current from the Clyde Valley Co.'s mains at 11,000 volts to the sub-station in an annexe to the Yarrow Co.'s engineering shop.

Here it is transformed to alternating current at 400 to 440 volts by oil-immersed static transformers of 600 kilowatts capacity. A fourth transformer is installed as a standby. The cubicle chamber into which the high-voltage current is brought, as well as the transformer house, are screened from the sub-station power. As most of the continuous current motors which the firm had in use at Poplar have been installed in the new works at Scotstoun, it was necessary to supply continuous current, at 210 volts, to run these machines. A motor generator set of 250 kilowatts was installed, the motor being driven by alternating current at 400 volts, and the generator producing continuous current at 210 volts. A spare motor generator set will also be installed as a standby. The main distribution board for continuous current is kept separate from the distributing board for alternating current. The mains communicating from the sub-station to the boiler shops and to the platers' shed are of insulated cable laid underground on the solid system. The wiring in the shops consists of bare copper where this can safely be used, but all mains which come down to the motors are of insulated cable. The work of laying the mains from the sub-station was carried out by the Callender Cable Company, but all the cables inside the shops, and also in the shipyard, have been installed by Messrs. Yarrow & Co. themselves.

By far the greater portion of the shipbuilding works situated in the area of the Electric Power Supply Companies of the North-east Coast of England obtain the bulk of their supply from the Companies' mains. The system of supply is a three-phase one, and current is supplied into the consumers' premises at 5750 volts (40 cycles) where it is transformed to 440 volts for use on the machines. Among the shipbuilding works taking their supplies from the power companies the following important firms may be mentioned:—Messrs. Armstrong, Whitworth & Co., Elswick and Walker; Messrs. Swan, Hunter & Wigham Richardson, Ltd.; Messrs. Dobson and Co.; Tyne Iron Shipbuilding Co.; The Tyne Commissioners Ship Repair Yard; The Northumberland Shipbuilding Co.; Messrs. R. W. Hawthorn, Leslie & Co. Messrs. Priestman's Shipyard; Messrs. Pickersgill & Co.

Electricity, as was asserted in our first article, is the great modern invader and conqueror, but co-eval—although not co-equal—with it, in shipyard operations in many establishments, the powers of compressed air and hydraulics are potent factors. It is worthy of emphasizing, further, that electricity more and more is helping out, if not in many ways superseding the two systems of power last mentioned. Electric motor driving is, in short, becoming universal, even where the plant engaged in generating compressed air and hydraulic pressure is involved. Where the electric system has been, with a full sense of its adaptability, provided its utilization for driving purposes, to isolated machines or to machinery in group, is of seemingly endless value. Thus, pumps for hydraulic work, and especially machinery for compressed air purposes, driven by electric motors, are almost every-day objects in the economy of modern shipyards.

To air compressors, electrically driven, (although gas power and power-belt transmission are still in vogue where circumstances have compelled their adoption) the remainder of this article will be devoted. Compressors for electrical drive are now common productions of a number of firms well known in this line of engineering, and it is chiefly to some typical motor-driven sets, as made by Messrs. Alley & MacLellan, Ltd., of the Sentinel Works, Polmadie, Glasgow, that we meantime draw attention.

Portable air compressors are used with effect in the finishing of ships in modern shipbuilding. Such a plant is taken alongside the building berth, and may be even lifted on to the deck, and in the latter case the compressor may be launched with the ship, and the air used for rapidly finishing the body when afloat. The tendency is, when the use of air is pretty fully developed, to have the air main laid alongside each building berth, and to carry temporary piping over the ship. The Fairfield Shipbuilding and Engineering Co., for example, have had a motor-driven portable air compressor set of 200 cubic ft. capacity running for several years, and doing good work. Figure 1 illustrates this machine, and is, in fact, reproduced from a photograph of it.

Messrs. Workman, Clark & Co. and Messrs. Harland and Wolff have also installed such portable sets, the one in use by the former firm being a 150 ft. plant, whilst that used by Messrs. Harland & Wolff at their Southampton yard—and which is one of the latest built—is of a capacity of 300 cubic ft. of free air per minute. This capacity of 300 ft. represents about the maximum that can be economically used for such sets, as it seems to reach the limit of easy handling and general efficiency. Such a plant is perfectly self-contained, only needing to be wheeled into place, and to have the cables and the air pipes coupled up, to be ready for use. As a general rule it is preferable to have a railway laid for the plant to run upon, as this prolongs the life of the plant, and in such plants as have been made for use on rails clamps have been fitted, the use of which is to securely anchor the machine in place, so that very little vibration is experienced when running under working conditions.

It is interesting to note that the Fairfield Shipbuilding and Engineering Co. and Messrs. Workman, Clark & Co. have had their portable sets made suitable for railways, whereas Messrs. Harland & Wolff at Southampton have had theirs made with broad road wheels, so that it may be wheeled over ordinary macadam or cobble roadways without danger. Another Clyde firm, Messrs. A. & J. Inglis, of Pointhouse, have favoured the portable style of machine, and are at the present moment installing a 150 ft. plant in their Pointhouse yard. This plant also will be fitted with broad road wheels. There is no doubt that these small sets are found very handy and prove serviceable tools, being complete as they are with compressor, motor, starter, air receiver, water circulating pump and tank, all mounted on a bogey, and protected from the inclemencies of the weather by a galvanized sheet iron roofing. It is found necessary in these machines to have the truck built up of channel sections securely riveted together to enable them to withstand strenuous working conditions, and it is a fact well worth noting that these plants are so well adapted for the conditions and are so perfectly automatic in their action that they are in constant daily use under the direction of unskilled labour, and that without giving trouble or requiring overhauling or repair. They have been built to meet the needs of present-day shipbuilding, and are exceedingly useful in capacities up to 300 ft., which figure, as already mentioned, seems to mark the limit of their economical use.

Stationary air compressors, however, are what are generally installed, this type being less expensive—capacity for capacity—in the largest number of cases. Referring to the productions of Messrs. Alley & MacLellan, these are arranged naturally according to the number of cranks which are used in the design, and this number does not usually exceed three, the machines being known generally as single-crank, two-crank and three-crank compressors. The three-crank machines are made up to the largest sizes in use, and at the present moment no machines with more than three cranks have been built for use in British shipyards, and in fact experience seems to point to a larger number than three being quite unnecessary.

The single-crank air compressing machine is made in sizes up to 700 cubic feet of free air per minute, and it is of very massive construction. The Clyde Shipbuilding and Engineering Co., of Port Glasgow, have had a 300 ft. motor-driven machine of this type running constantly for several years, and supplying air required for their large boiler shops and shipbuilding slips, whilst Messrs. D. & W. Henderson & Co., Ltd., have also a 200 ft. machine of this type in constant service. This single-crank machine is very compact and simple, and is specially suitable for fairly small demands for compressed air. The vertical design lends itself admirably to either direct gearing or coupling with an electric motor, and when the motor and compressor are mounted on a single combined bedplate the plant becomes very compact.

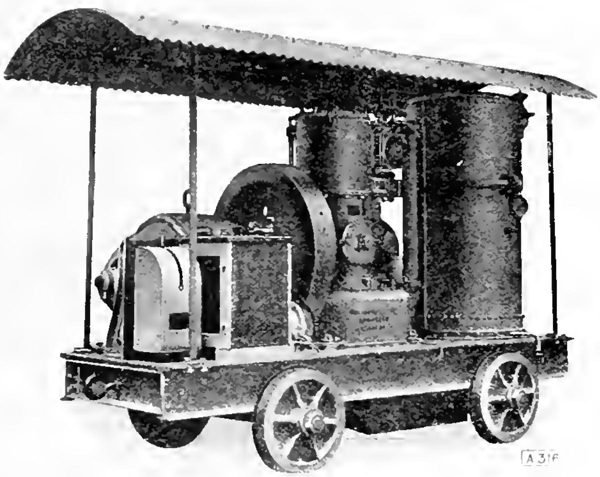


Fig. 1.—Portable Motor-driven Air-compressing Plant

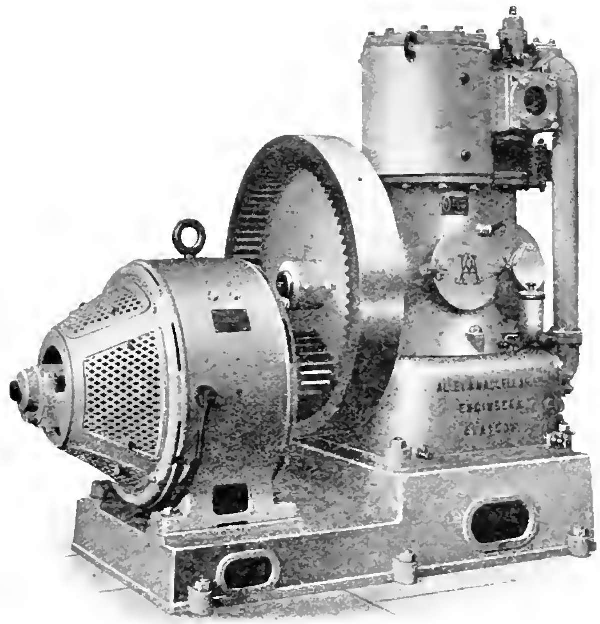


Fig. 2.—Single Crank Motor-driven Air Compressor

Messrs. John Brown & Co., Ltd., Clydebank, who have been using compressed air in their shipyard for a large number of years, have recently favoured the single-crank type of compressor, and have installed two duplicate machines in their shipyard power house. The duplicate arrangement is a good one, and is very helpful in event of break-downs at any time. Both of these machines are in constant use, but while, on the day shifts, it is necessary to have the two machines running, on the night shifts one machine only requires to be run. Both of these compressors discharge into one large air receiver placed outside the power house, and the arrangement of valves is such that either of the compressors can be entirely shut off from the air mains if necessary at any time. Indeed, the arrangement seems to be a very satisfactory one all round, and has much to

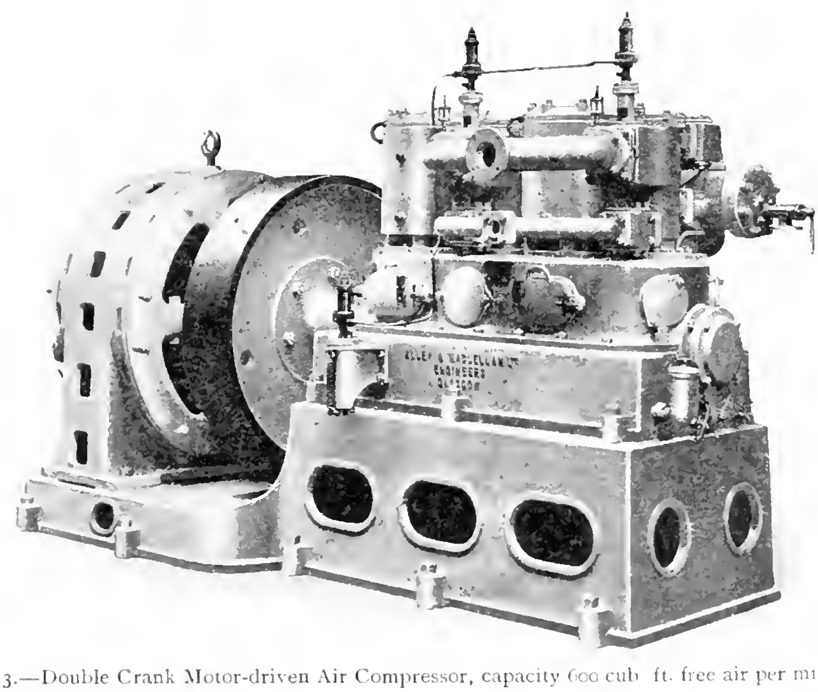


Fig. 3.—Double Crank Motor-driven Air Compressor, capacity 600 cub. ft. free air per minute

recommend it. Figure 2 shows the general appearance of single-crank motor-driven air compressors as recently installed.

Where the demands for air necessitates larger machines than can be economically built with one crank, it is found of advantage to have two cranks in the design, which means that the compressor is built in two complete lines of parts, the general outside appearance being as shown in figure 3. Such an arrangement of the machine keeps down head room and weight to easy handling reach. Messrs. Swan, Hunter and Wigham Richardson, on the Tyne, have two machines of this type in constant use, the largest and latest of them having an actual continuous output of 600 cubic feet free air per minute to 100 lbs. pressure, and these machines ensure an ample supply of compressed air to the very large number of pneumatic tools required by this well-known firm. Similar machines of the two-crank type are also in use by the North-Eastern Marine Engineering Co., of Sunderland, and the Greenock and Grangemouth Dockyard Co., of Greenock, these machines being all of the 600 ft. size, and in constant daily use. There seems to be no doubt that, from the experience of these and other firms, the two-crank machine meets the largest number of cases more satisfactorily than any other type of compressor now made.

To meet the requirements of shipbuilding and engineering works of very large capacity, the triple line, or three-crank machine, is now made. The most common size made in three lines of parts is of a capacity of 1200 cubic ft. of free air per minute, and it is one which is exceptionally handy and compact in its general design and arrangement. Figure 4 shows a direct-coupled motor-driven set of this size, and when such firms as Messrs. Workman, Clark & Co., Palmers Shipbuilding and Iron Co., and Messrs. Sir W. G. Armstrong, Whitworth and Co., of Newcastle, instal these large units, and, in fact, give repeat orders for them at later dates, there is no doubt that they are in every way satisfactory.

So far as the general design of the "Sentinel" air compressor itself is concerned, there is very little difference apparent in the parts, whether it is single, double or triple type. The air cylinders, valve gear, and intercooler remain of exactly similar design, and, in fact, the working parts for a single and double and triple compressor may be identical in every respect, so that the parts such as connecting rods, eccentric rods, pistons, etc., may be interchanged and used with far more freedom than is commonly allowable. The one great advantage, however, of the multiple cylinder system is with regard to the high efficiency, both mechanical and volumetric, which may be and is obtained in actual practice. In the multiple cylinder machine also the balancing of moving parts is almost perfect, whilst the large cooling surface and small clearance volumes of the air cylinder represent the ideal conditions necessary for air compressor machinery.

It is in the electrical equipment, however, of these various types of compressors that some change is perceptible and principally in the drive between the motor and the compressor. In small single-crank machines this drive may quite well be through gearing, and in the large majority of cases this is the method adopted on account of economy both in first cost and in overall dimensions of the plant itself. In the large two and three-crank compressors, however, which are now becoming common, the drive is made direct from motor to compressor, and this has undoubtedly been a great influence in the bringing of motor-driven compressors into their present high favour. Very high through efficiencies are obtainable by this method, and economical running expenses are assured, whilst the first cost is comparatively small, owing principally to the fact that the compressors themselves run at the fairly high speeds of from 250 r.p.m. to 340 r.p.m., which speeds are specially suitable for large power electrical motors, as now standardized. It is an undoubted fact that, wherever electrical supply power is comparatively cheap, the motor-driven air compressor is the machine favoured. For instance, in the shipyards on the river Tyne, where energy is sold at a very cheap rate, Messrs. Alley & MacLellan, Ltd., have installed many motor-driven machines of considerable sizes, one firm alone having 1000 h.p.

The "Sentinel" motor-driven air compressor as now made is fitted with many special devices to ensure automatic working and highest possible economy in consumption. The simplest of these is perhaps the standard air governor and unloading device, which automatically maintains a constant air pressure in the receiver, and regulates the output of the compressor according to the demands of the pneumatic tools for air by its direct actuation of the compressor air inlet valve. This governor does not at any time stop the running of the machine, but merely runs it loaded or unloaded according to the demands for air, and when the machine runs unloaded, which it does when the air inlet valve is closed, the current consumption at the motor is only a small percentage of that required under full load conditions.

Another special device very often fitted is now well known as the automatic stopping and starting gear, and this gear is an improvement on the simple air governor above mentioned, and it is favoured where economical running is of first importance. The only objection to the fitting of this automatic stopping and starting gear is its comp ratively high initial cost. This gear, as its name implies, is perfectly automatic in its action, and completely controls the working of the compressor. It stops the machine dead when the pressure rises to, say, 10 lbs. above the working air pressure, and it does not restart it until the pressure of the air has fallen, say, 10 lbs. below the working pressure. Special precautions are, of course, necessary in the design of such a gear, but an experience with it extending over a period of years has now perfected its adoption, and made it reliable and entirely practical.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

The Lund Line.

THOUGH the unfortunate steamship *Waratah* has been officially posted as missing, and though the Probate Court has allowed the death of her master, Captain Ilbery, to be presumed as from the day on which his vessel left Durban, hope is not yet dead in the hearts of those connected with her ill-fated passengers and crew. Messrs. Harris & Dixon's steamship *Wakefield* is under charter to go on a cruise similar to that unsuccessfully undertaken by the Union Castle liner *Sabine* in September. She is ordered to actually visit—not merely steam past—Prince Edward and Marion Islands, the Crozets and Kergruelen, as well as Amsterdam Island and that of St. Paul. A large surf boat is to be carried in order to facilitate the landing of search parties at these difficult places. Like the *Sabine* she is to carry a naval officer and a complement of bluejackets to work the search light. Of course it is in favour of the theory that she may still be afloat that no wreckage identifiable as from her has been seen. But against hopes raised on this assumption may be urged the fact of the immensity of the Indian Ocean and of the great possibility that wreckage from any particular ship, even if afloat, may not be sighted in that lonely sea. There is also a pertinent question, to which as yet no satisfactory answer has been given by those who urge renewed search. It is this—If the *Waratah* be still drifting, or if she has reached an island where her people have been able to land, what has kept her officers and crew idle all these months? They had a good supply of boats duly equipped. They had plenty of provisions. They are not the men to sit down and fold their hands waiting for outside assistance, which may possibly only come when they are starved to death. They would have done what other mariners have done under similar conditions—*viz.*, sent boat expeditions away to intercept steamers passing on the regular track, or to reach a coast which is in touch with the civilized world, so that the news of the safety of the ship's complement may be flashed over the world, and an expedition sent off to a known goal prepared to deal with the situation as it may in fact present itself. The cost of the *Wakefield's* voyage is estimated at about £5,000, and that sum is being found as to one half in Australia and as to the other moiety in this country.

Meanwhile the Lund line has merged its existence in that of the P. & O. Company. Their five remaining vessels and the goodwill of the business have been taken over by the great Company in Leadenhall Street, and though it is said that no change in management is to be anticipated at present

important results must eventually follow. For one thing this absorption gives the P. & O. an entry into the Cape trade, and furnishes them with another mail contract in that they take over the carriage of the mails between South Africa and Australia.

The fleet transferred is as follows :—

Ship.	Year built.	Gross tonnage.	Builders.	Place of build.
Geelong, twin-screw	1904	7,954	Barclay, Curle and Co.	Glasgow
Commonwealth, twin-screw	1902	6,611	Barclay, Curle and Co.	Glasgow
Wilcannia, single-screw	1899	4,958	Sunderland S.B. Co.	Sunderland
Wakool, single-screw	1898	5,004	Sunderland S.B. Co.	Sunderland
Narrung, single-screw	1896	5,078	Sunderland S.B. Co.	Sunderland

It was in the sixties that Mr. Wilhelm Lund first entered the Australian trade with a fleet of sailing vessels. Like so many other sailing ship owners, however, Mr. Lund found that the advance of marine engineering effected such economies in steam transit that the sailing ship was becoming a less lucrative investment than the cargo steamship and accordingly in 1880 he entered the steam trade with the *Delcomyn*, a vessel of small tonnage by modern standards, she being of between eighteen and nineteen hundred tons gross register. The success of this vessel was such as to encourage him in his determination to acquire a steam fleet, and for many years his regular service has been maintained by steamships, whose size, power, and accommodation have been improved with each successive addition to his fleet. It will be remembered that this is not the first occasion on which the P. & O. has felt it desirable to take over the ships of other steamship owners. As an instance may be quoted the purchase of certain steamers of the Hall Line some years ago. Three vessels were then acquired, and with them their late owners gave up to the purchasers their passenger business between this country and Bombay.

The Hamburg-American Co.

is finding a difficulty in reconciling its obligations to the tourists who are circumnavigating the globe in their new twin-screw passenger steamer *Cleveland* with the provisions of American law. It appears that the great liner shipped a complement of some 650 tourists at New York for the round-the-world trip. The itinerary—as far as the steamship was concerned—was arranged to end at San Francisco, the trip back to New York being of course completed by railroad. This tour was evidently planned in forgetfulness of the fact that the coasting trade of the United States is reserved for vessels flying the Stars and Stripes. If, therefore, the *Cleveland* should disembark her passengers at San Francisco, as arranged, her owners will become liable under the Law of the Republic to a fine of no less than two hundred dollars a head—a sum which, if multiplied by 650, will be no small matter even to a big steamship company. The terms of the section under which the penalty will be claimed seem clear enough. The voyage commenced at a port on the Atlantic coast and is to terminate at another on the Pacific sea-board, and all trade between United States ports is held to be technically coasting trade. The steamship owners, indeed, have a defence in so much as they can direct attention to the fact that the voyage is not being effected between the two ports direct, as calls will be made at many places in various foreign lands *en route*. On this fact they can base an argument that the voyage is not really a mere coasting trip, but a foreign excursion begun from one United States port and ended at another for passengers' convenience. But I doubt if the defence will be of much avail under the Customs Law. One cannot suppose, however, that even if the Courts hold that this is in law a coasting voyage the authorities will be so illiberal as to enforce more than a nominal penalty. For one thing is certain. The American mercantile marine could not at present spare one of its own ships for such a tour, and, if foreign vessels are debarred from this trade, American globe trotters must do without such trips, till the distant day in which the expansion of the American marine enables them to use its surplus steamers.

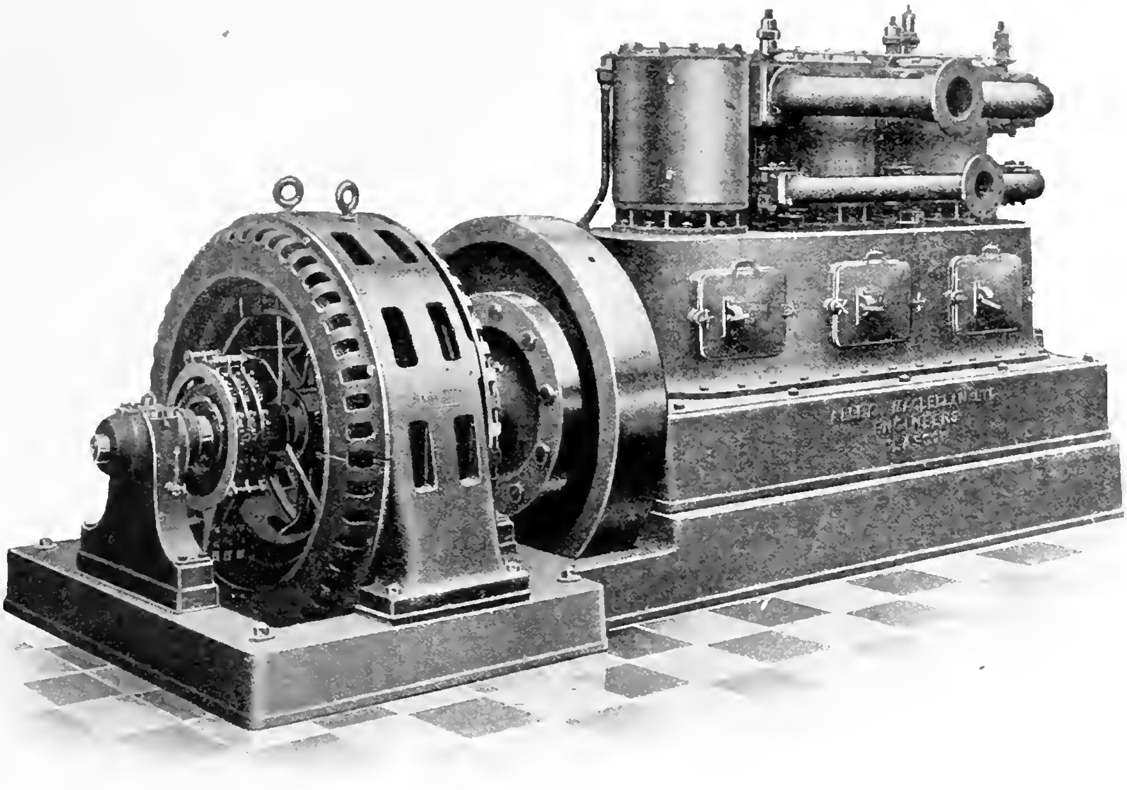


Fig. 4.—Triple-crank Motor-driven Air Compressor. Capacity, 1,200 cub. ft. free air per minute. See "Modern Shipyard Machinery," page 290

That the corner has been turned in the shipping trade—at all events by those who by the modern design of their fleet and by the advantages of their business connections are able to take advantage of the improved condition of things—seems to be evidenced by the preliminary statement of their working for the year 1909, just issued by the Hamburg-American line. I give it in tabular form:—

Year.	Gross Earnings (Marks).	Profits (Marks).	Allowance for Depreciation (Marks).	Dividend (per cent.)
1906	34,469 431	32,303,571	21,782,200	10
1907	27 355,418	25,235,497	17,796,637	6
1908	15,855,537	12,881,552	12,881,552	—
1909	32,000,000	29,000,000	20,000,000	6

It will be seen that a large amount has been allotted to the increase of the depreciation fund, whilst at the same time a sum of two million of marks has been added to the insurance fund. This shows plainly enough that the enhanced dividend has not been obtained at the expense of capital or by the anticipation of future earnings. Two large new vessels have been ordered in British yards, and the statement is made that the necessary payments in connection with their construction have been provided without the need for any borrowings.

The Combine

is still disposing of its old tonnage. The *Kensington*—a twin-screw liner built in 1894 for the American line by Messrs. J. & G. Thomson at the Clydebank yard—has left the Mersey for the scrap-heap of a foreign shipbreaker, and now the single-screw liner *Roman*—built ten years previously by Messrs. Laird, at Birkenhead, for the British and North Atlantic Steam Navigation Company, and employed by them in the Dominion line service—has been disposed of to Messrs. J. J. King, of Garston.

Messrs. Elder, Dempster & Co.

have sold their steamship *Biafra*, which was built in 1895 at Middlesbrough, to the Bombay and Persia Steam Navigation Company. The buyers of this vessel have just lost a steamer, the *Mozaffari*, by stranding at the entrance to the harbour at Ibo on the eastern coast of Africa. The Indian Ocean seems to have again experienced dangerous weather, for a British India steamship, the *Loodiana*, of 3,269 tons gross register is badly overdue on her voyage from Mauritius towards Colombo. She sailed on the 10th January with about seventy native and ten European passengers. As she was not heard of, the Company's steamship *Itola* was sent in search. Having visited the Cardogas group of islands and been some distance towards Reunion, she returned on the 10th February, and announced that she had found no trace of the missing steamer. The *Loodiana* was built in the year 1884 by Messrs. Denny, of Dumbarton.

A Remarkable Salvage Feat

has been performed in the floating of the Belfast steamship *Glynn*, a vessel of 1,100 tons gross register, which stranded near Octeville on the Brittany coast at the beginning of February. The steamer lay on a ridge of limestone rocks, and sustained extensive damage to her bottom, including a large hole under the machinery space. The crew landed and went to Havre. The surveyors considered the case a bad one, as there seemed to be every indication that the vessel was breaking up. After three days' work, however, the *Glynn*, on which sixty guineas per cent. was being paid for re-insurances, was floated by the salvors and towed into the port of Havre.

Seamen and the Law.

The position of seamen is of course peculiar as against that of land workmen in regard to their claims for compensation under the Workmen's Compensation Acts, from the fact that throughout the voyage, living on board as they do, they are necessarily on their employer's premises. In the recent case of Rice against the owners of the steamship *Swansea Vale*, the Court of Appeal had to consider a claim arising out of the death of the first mate of that steamship, who went on to the bridge for the morning watch in the discharge of his duty and who had disappeared when his watch was relieved. He had complained the previous evening of being unwell and had taken a dose of physic. On these facts the Court had to decide whether his death could be rightly assumed to have been caused by an accident arising out of his employment. There was obviously evidence from which it might be assumed that he died from an accident "in the course of his employment." But the Court had to consider whether the facts warranted it in going further and assuming that the accident arose "out of" that employment. By a majority the Court found in favour of the claim, and it seems just that in such a case, where there is no direct evidence, but where a man was last seen on duty, and on duty under trying circumstances, it should be presumed that he met with an unexplained accident in the continuance of his work. In considering the high character of the officers of the Mercantile Marine, whether navigating or engineering, it would be casting a slur on the whole profession if it were presumed that in the absence of direct evidence that duty would, under any circumstances be neglected.

Disasters

The loss of the Compagnie Générale Transatlantique's steamship *General Chanzy* on the coast of Minorca is by no means the first wreck of passenger vessels belonging to that undertaking. The most recent previous wreck was that of the *Isaac Pereire*. This occurred as lately as the 26th October, 1906, on the same coast. How the present disaster occurred seems at present shrouded in mystery, though there can be but little doubt that the vessel got out of her course and struck the rocks. M. Rodel—the sole survivor—speaks of a terrific explosion and again the theory of bursting boilers—so often shown to be practically against the natural order of things—is put forward. An explosion there may have been, but it apparently took place after, not before, the wreck, and it may well have been due to the fact that the shock of the contact ignited in some way the gunpowder and ammunition which are said to have been comprised in the cargo. This view is supported by the news that mail bags showing traces of fire have been recovered. These indications are compatible with a gunpowder, but not with a boiler explosion. Another heavy loss is that of the Pacific Steam Navigation Company's steamship *Lima*, not, as first reported, in the fatal Straits of Magellan but on the Island of Huamplin. She was on her outward voyage to the West Coast of South America and carried a large crew and many passengers, and the loss of life here also is heavy, though there are a great many survivors. The *Lima* was quite a new vessel, having been built as recently as the year 1907 on the Clyde.

The late Sir Alfred Jones.

Early in February it was rumoured that a well-known shipbuilder from the North of Ireland is likely to take up many of the interests of the late Sir Alfred Jones. It has now transpired that Lord Pirrie, of Messrs. Harland and Wolff's firm, is taking over the whole of the interests involved. As the purchaser is already so closely connected with the American shipping combine and in a less degree with Messrs. Donald Currie's, it may well be that this acquisition will be one of the most important developments of the day.

MESSRS. LEONARD CHAPMAN & CO., Importers and Manufacturers, Munton Road, London S.E., report:—Graphite as imported, according to quality

Ceylon L.L. c.i.f. London	£20 10 0 to £43 15 0	per ton
„ O.L.	15 15 0 to 43 15 0	„
„ chips	12 15 0 to 31 15 0	„
„ dust	9 10 0 to 25 0 0	„
Purified, milled and ground.		
Ceylon 97% to 99% f.o.b. London	59 0 0 to 63 0 0	per ton
„ 90% to 91%	40 0 0 to 42 0 0	„
„ 80% to 81%	30 0 0 to 32 0 0	„
„ 70% to 71%	27 0 0 to 28 0 0	„
American large flake, f.o.b. London	45 0 0 to 49 0 0	„
„ small	35 0 0 to 45 0 0	„
Graphite Joint Compd.	2 9 0 to 2 12 6	per cwt.
Graphite Paint Paste	2 2 0 to 2 5 0	„
Graphite Paint	0 4 9 to 0 5 3	per gal.

Wholesale lists of tinned goods on application.

DOUBLE BOTTOMS IN MODERN STEEL VESSELS.

II.

IN our last article we endeavoured to give some outline of the practice of fitting double bottoms in merchant steamers as it is familiar to us, and we also attempted a general examination and comparison of the types of double bottom now in vogue. It was there shown that the practice, as it is at present known, had crystallized in a more or less haphazard manner from the earliest attempts to carry water-ballast, and that there was no attempt to conform to any recognised standard of strength. The strength of the ordinary double bottom, as we know it, was also examined, and it was found that, on a basis of comparison from the conditions of actual sea service, there was a very considerable excess of strength over the other parts of the structure for resisting both structural and local deformation. The conclusions reached would be endorsed, it is believed, by very many naval architects and designers, and this is to a certain extent proved by the many attempts to lighten the structure which have recently been made.

Now, in any attempt of this kind one is "up against" two rather prohibitive conditions. First, in nearly all cases the dimensions of the water-carrying space cannot be reduced. Each vessel must carry a certain amount of water ballast, and it is therefore futile to suggest a reduction of depth, either of the centre girder or of the margin plate. In the second place no substantial reduction of thicknesses can be made. Thicknesses have already been reduced as far as is possible in a case where liability to corrosion is so pronounced. Indeed some people hold strongly the opinion that they have already been unduly reduced. There is therefore only one direction left in which reductions can be made, *viz.*, by an economy in the number of parts. And this, as a matter of fact, is the direction which all recent efforts in this respect have taken.

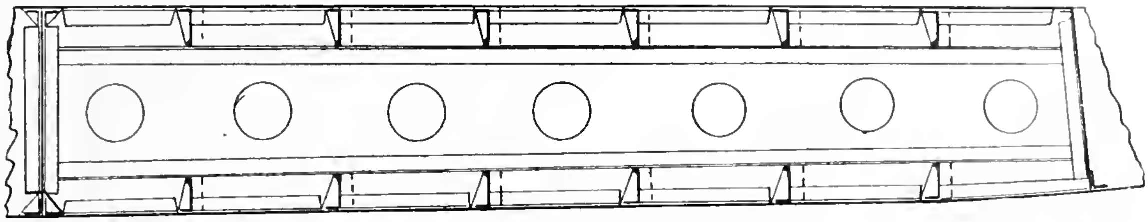


Fig 1

Prominent amongst these must first be mentioned the double bottoms fitted in vessels built on the longitudinal system. This system, as we need hardly remind our readers, is associated with the name of Mr. Isherwood, and has for its principal feature the fitting of strong thwartship webs throughout the length of the ship, between which is run a series of longitudinal bulb-angle frames about 30" apart, which support the shell plating. This idea is also carried out in the bottom. The strong webs become in the bottom the ordinary floor plates, and are spaced five or six feet apart. Between these, supporting the shell and double bottom plating, is fitted a series of longitudinal frames, spaced about 30" apart, and Figs. 1 and 2 show alternative methods of constructing the bottom by this method.

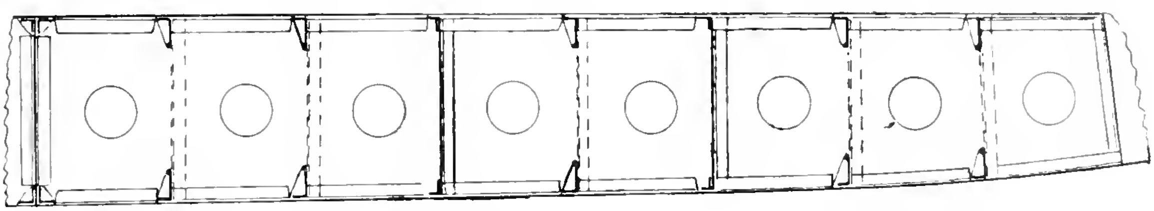


Fig 2

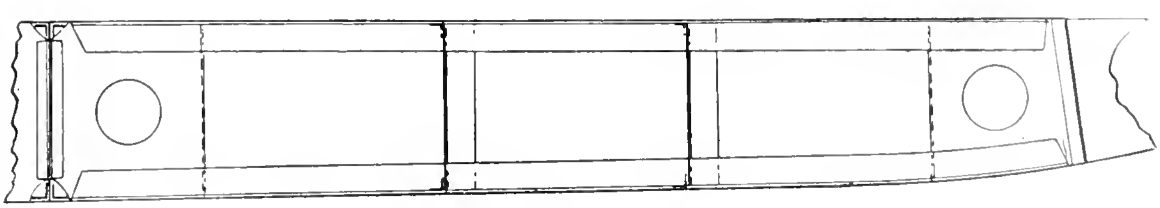


Fig 3

In Fig. 1 it will be observed that there are no plate longitudinal girders fitted, whilst in Fig. 2 there are two of these girders shown. It is understood that the method of construction shown in Fig. 1 has been adopted in two vessels, and that so far it has proved satisfactory. It is a fair subject for question, however, whether, in ordinary cargo vessels of from 350

to 400 feet in length, the presence of one girder between the centre line and margin plate is not a necessity. Taking the double bottom alone, we find, in this method of construction, that the only material resisting the longitudinal shearing stresses (which are not inconsiderable) is the centre girder and the two margin plates. We repeat that it is something less than doubtful whether the above is sufficient, and it must be conceded that the structure presents something of the appearance of a girder which is deficient in bracing. However that may be it is of interest to note that the compensation fitted appears to be distributed on the lines indicated as being proper in our first article. The floors, by reason of their relatively greater rigidity, take much the larger proportion of the load incident on the bottom. When the number of these floors is reduced, it is necessary to increase the thickness of the others, or efficiently to stiffen them. This is done by fitting vertical stiffening bars in line with the top and bottom longitudinal,—an efficient resistance to buckling between the manholes —the place where it almost invariably takes place.

The sketch shown in Fig. 3 is intended to be adopted in vessels built in the usual way. The floors, instead of being fitted on every frame, or on alternate frames, are fitted on every third frame. Between each of these solid floors are fitted two "skeleton" floors, shown on the sketch, which consist of strong bulb angles fitted to the tank top and shell plating respectively, connected by flanged brackets at the centre girder, and margin plate. These bulb angles are designed for the span between the longitudinal plate girders, of which there may be two or three, depending on the size of the vessel. In contrasting the two systems, it may be pointed out that that represented in Fig. 3 is a more determinable structure than those in Figs. 1 and 2. In the latter, the longitudinal bulb angles not only support the plating against local pressure, but they also take part in resisting the structural compressive stresses on the ball. These two effects will be cumulative, and it is a matter of difficulty to determine what actual proportion exists between them, and what the cumulative effect will be. In Fig. 3, on the other hand, almost the whole of the work performed by the transverse bulb angles consists in supporting the plating between the girders. The strength of these bulb angles can therefore be related to any given standard with much more exactness than in the other cases.

It might also be pointed out that there is not the same necessity for increasing the scantlings of the floor plates in the type shown in Fig. 3. In the longitudinal system, practically the whole of the load on the bottom is transferred to the floors and by them to the support at their ends. In the transverse systems, however, a part of the load is delivered directly to the end supports by the transverse bulb angles.

MESSRS. RAMAGE & FERGUSON, LTD., shipbuilders, Leith, have received an order to build a steel screw coasting steamer for Irish owners.

DRY STEAM SUPPLY FOR WHISTLES.—In the article in the February issue, the word "no" was omitted between "using" and "auxiliary." The passage should read "in steamers using no auxiliary engine or apparatus constantly at sea a special pipe may be fitted as a whistle main." Mr. Yates informs us that a patent has been granted to him under No. 10558 of 1909.

SOME TYPES OF MARINE ENGINE GOVERNORS.

(BY JASPER E. COOPER.)

IT is hardly necessary to mention that the reciprocating marine steam engine is, perhaps more than any other, in need of an efficient governor. It is liable to have the whole load removed at any moment by the propeller coming out of the sea, and to have it as suddenly applied again, as the stern of the vessel takes the water. There are times as one stands, throttle valve lever in hand, when it seems that the entire engine will fall in pieces with the vibration caused by the revolutions being suddenly doubled, and the next moment the engines nearly stop, as the propeller strikes the water. Those of our readers who have had the unpleasant experience of being unable to leave the throttle during an entire watch will agree that an efficient governor is a very necessary fitting to all marine engines.

There are a great many ships fitted with some form of engine governor, but very few of the older forms are ever used, either because they never were efficient or because they have been neglected and allowed to get out of order. We propose to give a brief description of some of the more important of the old governors in addition to the more recent ones.

We find an ordinary centrifugal ball governor fitted to the engines of the *Comet*, built in 1811, but this form is obviously unsuitable for sea work. In 1856 Newton brought out an improvement in these governors, and the following year Taylor introduced a governor on a new principle. A cylinder was placed near the propeller connected at the bottom to the sea; a float in this cylinder was connected to the throttle valve by means of a chain, with a balance-weight at the further end. When the propeller was deeply immersed, the sea would fill the cylinder and keep the float at the top and the throttle valve open, but as soon as the head of water decreased, the float would fall until, the propeller being out of water, the throttle would be closed. In theory, this governor was good, but the practical difficulties were great. Consequently Silver's governor, invented the same year, gave greater satisfaction, and was more generally used.

Silver's governor is shown in fig. 1. **A** is a large fly-wheel fitted with vanes (to absorb a certain amount of energy) and free to revolve on the shaft **S**, which is supported by brackets bolted to any convenient bulkhead. The bevel wheel **B** is keyed to the shaft, and toothed quadrants **C1** and **C2** gear with it, and are free to turn about pins on the extended boss of the fly-wheel. A rope is taken from some convenient position on the propeller-shaft and drives the pulley **D**, thus revolving the bevel wheel, quadrants and fly-wheel. If the engine tends to race, the fly-wheel "lags behind" until the additional force has been supplied to overcome the inertia. This force causes the quadrants to partially revolve about their point of suspension, thus compressing the spring **E** and closing the throttle-valve by means of the bell-crank lever **H**. The objection to this governor is that it has to be of such large dimensions before it can satisfactorily work within the ordinary limits of speed, owing to the force

closing the throttle being dependent upon the change of inertia of the fly-wheel.

Following closely upon the heels of this governor came several others, constructed upon various principles.

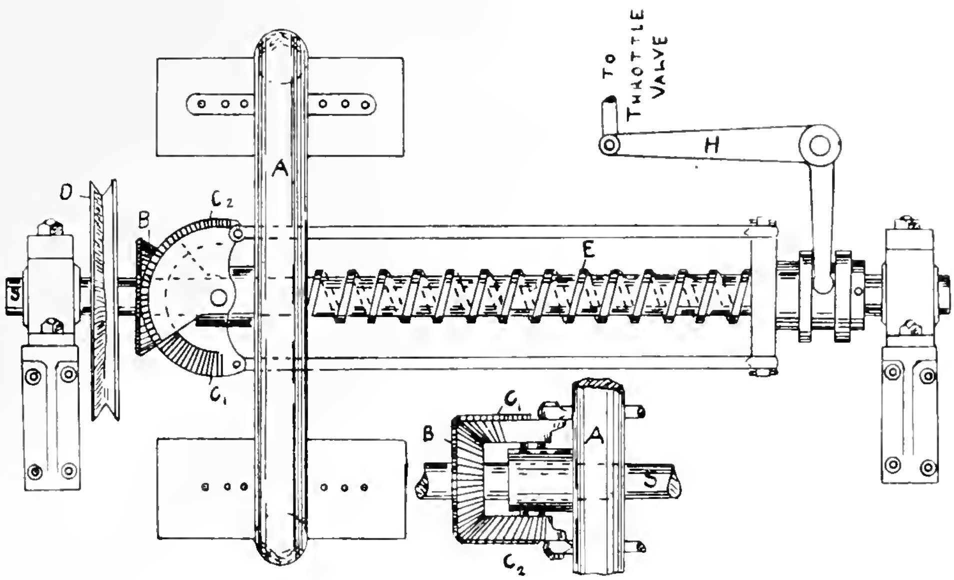
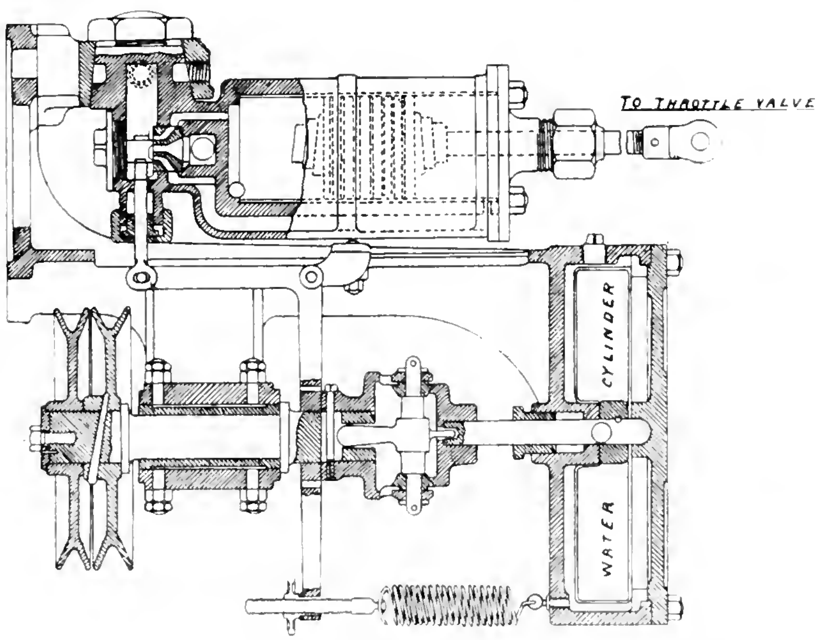


Fig 1.—Silver's Governor.

Pinker's relied upon the movement of the ship relative to a suspended pendulum. Meriton's was upon the same principle as Silver's, but employed different means for obtaining the necessary movement to actuate the throttle. A. V. Newton invented a governor dependent upon the difference in speed between the main engines and a small engine kept running at a constant speed. But no very great advance was made until 1871, when Dunlop invented his governor.

Dunlop's governor consists in its improved form of a sea-cock at the stern of the ship opening into an air vessel or air chamber, so constructed that, by opening the sea-cock, water is allowed to flow into the air vessel and compress the air contained therein to pressure equivalent to the head of water outside the ship. From the top of the air chamber a pipe is led to the under side of an air-tight elastic diaphragm, forming part of an apparatus in the engine-room. On the top of upper side of the diaphragm there is a spiral spring, with means of adjusting its compression, to balance the air pressure below the diaphragm. From the centre of the diaphragm a connection is made to the slide valve of a small steam cylinder, so constructed that its steam piston, which is connected

Fig 2



Churchill's Governor

by suitable gear to the steam valve of the engines whose speed is to be controlled, moves in exact accordance with the movements of the diaphragm.

The most important feature claimed for this governor is that it will anticipate any increase in the speed of the engines, so long as that increase is due to the propeller being out of water; but, in the case of a shaft breaking, it is of no use, the engines would then race as heavily as if there was no governor fitted.

In 1874 Lake invented a governor, relying upon a principle of churning water in a drum to obtain a constant speed, with a mechanism for closing the throttle when the engines tend to race, but it was left for Churchill in 1879 to apply this principle in practice.

CHURCHILL'S.—A great number of marine engines were fitted with this governor, which was undoubtedly the best of its day, and one still finds them afloat on many of the older boats. Fig. 2 is a sectional elevation, from which it will be seen that the main casting consists of a bracket for bolting on to the bulkhead or other support, carrying a depending bracket for the driving spindle; and at the further end is the water, or retarding cylinder, with baffles. Within this cylinder is a fan, carried by the fan spindle working through a gland and stuffing box. On the end of the fan spindle is a small cup, which has two pieces cut out of its sides so as to form a double cam. This cup works inside a larger one (carried by the driving spindle), which cup has two parallel slots cut in it. The driving spindle carries a V-shaped driving sheave, and also a loose sheave. When it is in action the power to drive the fan is transmitted from the large cup to the small cup through the intermediate spindle, causing it to mount the inclines of the cams, thereby forcing the long arm further into the hole in the driving-shaft and carrying with it the pin which passes through the collar and slotted hole, thus moving the collar and its skid and carrying with it the bell-crank lever against the tension of the spring. At the same time, the short arm of the bell-crank alters the position of the small slide-valve operating the piston in the auxiliary steam cylinder. The movement of the intermediate spindle is controlled by the spring attached to the long arm of the bell-crank. This spring is adjustable by a thumb-screw.

The principle on which this machine acts is very simple. On the one side you have work done in the water cylinder, on the other side the tension of a spring, the differential gear being the fulcrum or pivot on which the two forces are balanced. If the work done in the water cylinder, by reason of increment of speed, exceeds the tension of the spring the balance is upset and the throttle-valve is partially or wholly closed and *vice versa*.

COUTTS AND ADAMSON'S.—This governor, invented 1880, works upon the same principle as Dunlop's, but has a different mechanism for causing the variation of head of water at the stern of the vessel to actuate the throttle-valve. Fig. 3 shows an elevation partly in section, of this governor. A stand-pipe is placed in the stern of the vessel with a cock at the lower end opening into the sea. The upper end of this pipe is connected to the pipe A, consequently any variation of pressure at the stern of the vessel, due to the different depths of immersion of the propeller, is transmitted to the box D and causes the diaphragm E to fluctuate. The diaphragm has a spring fitted to the under-side, and the pressure of this spring can be adjusted by means of the nut G. A spindle passing through the diaphragm is connected with the valve J. If the pressure on the diaphragm is that due to the required head of water at the stern this valve J remains in its lower position, so that the lower side of the piston in the cylinder O is open to the condenser by means of the connection on M. But, when the pressure on the diaphragm falls, the valve J is lifted and steam forces the piston up, N being connected to a convenient lead of

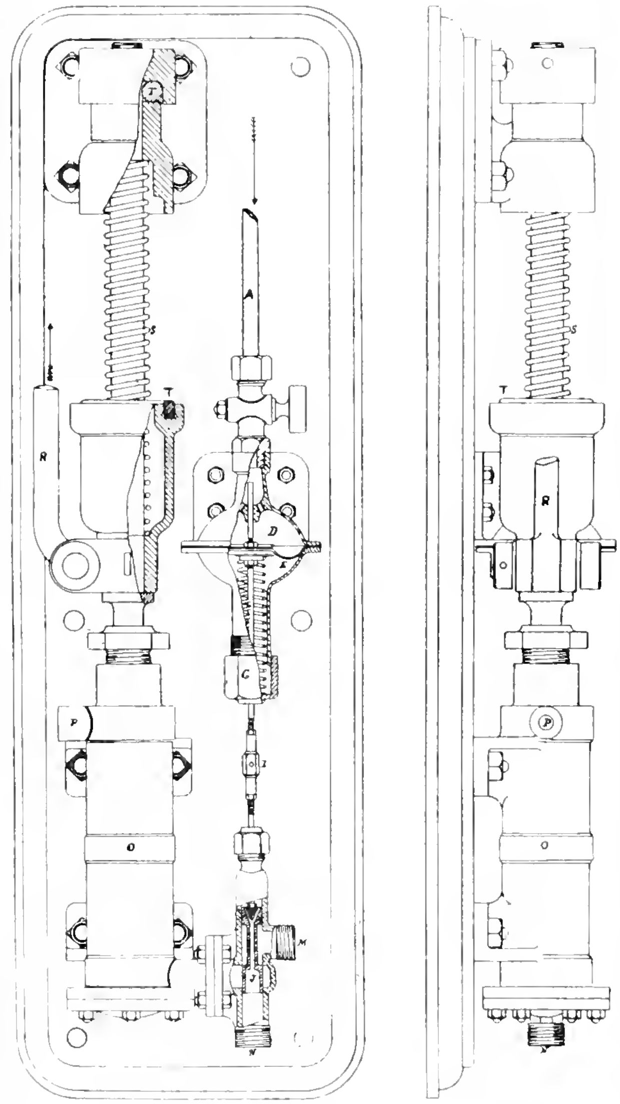


Fig 3.—Coutts and Adamson's Governor

main steam. The upper side of the piston is open to the atmosphere at P and the piston is connected to the throttle-valve by means of the rod R, so that when the piston is at the top of its stroke the throttle is closed. The spring S, combined with the atmospheric pressure, forces the piston down again when the pressure on the diaphragm again causes the valve J to shut off steam and open the lower end of the cylinder to the condenser. Rubber buffers are provided at T T to take up any knock when the piston reaches the top of its stroke. This governor possesses the advantages and disadvantages of the Dunlop governor.

The "Thunderbolt" governor (fig. 4) consists of a set of duplex double-acting air-compressors, a patent automatic adjustable regulator and a cylinder containing a piston for controlling the throttle-valve. These parts are attached to any convenient place in the engine room and are connected by a half-inch copper pipe through which the air is conveyed.

When this governor is in action the air-compressors **A**—driven from the main shaft by a belt or any other means to the patent clutch pulley **B**—force air at a predetermined uniform pressure through the pipes **B**¹ and throttling valve. With the return motion of the vessel the pendulum will, by the same means, re-open the throttling valve.

It will thus be seen that the action of the pendulum **E**¹ causes the synchronous movement of the piston rod **D**¹, and with it the throttle valve of the engine, thus anticipating the racing when the propeller is insufficiently covered.

Aspinall's.—This governor is shown in figs. 5 and 6. It relies upon the old principle of inertia, but is entirely new in its application of that principle. One

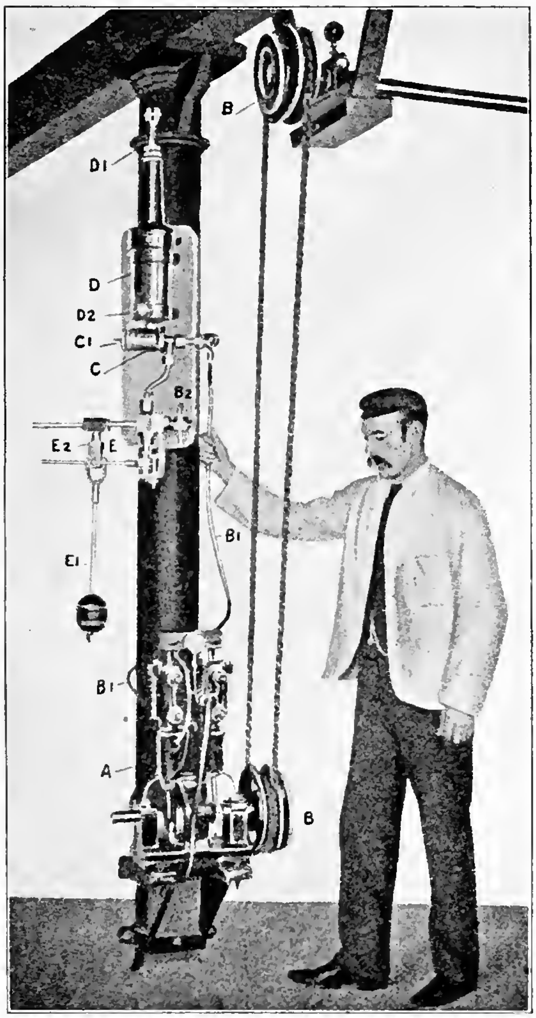
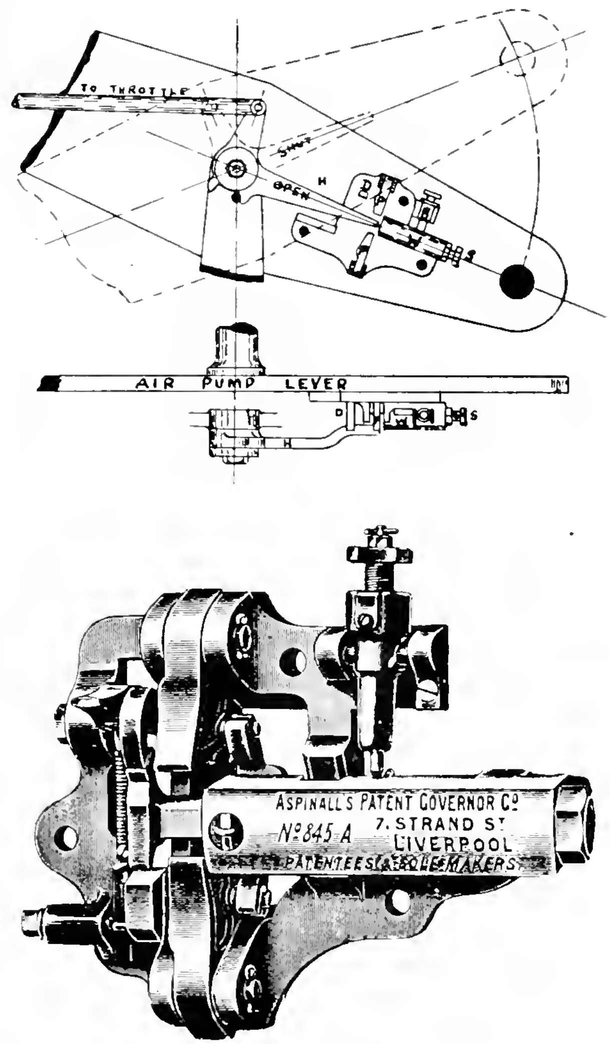


Fig 4.—The "Thunderbolt" Governor.



Figs 5 and 6.—Aspinall's Governor.

B², having an outlet at **E**. Any tendency on the part of the engines to exceed the adjusted maximum speed would cause the air compressors to discharge more air than could escape through the adjusted outlet valve **E**, thus increasing the air pressure against the piston **C**¹ which would be forced back and the air admitted to the throttling cylinder **D**. As the stern of the vessel rises, the pendulum **E**¹ operates and closes the outlet valve **E** and the increased pressure forces back the piston **C**¹, which allows the air to enter the cylinder **D** and force up the piston rod **D**¹ so as to close the of the great advantages of this governor is that it is always ready to close the throttle-valve immediately a predetermined increase of speed takes place, no matter from what cause, without using up energy, as is the case with rope-driven governors. The only time this governor actually absorbs energy is when it is either opening or closing the throttle-valve. It can be adjusted so that an increase of only a few revolutions per minute will cause the throttle to close, or, if required, it can be made to act only upon a much greater increase of speed; but in either case

the throttle is opened again immediately the engines slow down to their normal revolutions, except in a case of a shaft breaking, when an emergency gear comes into action and closes the throttle so that it has to be opened by hand before the engines can be re-started.

Referring to figs. 5 and 6, it will be seen that the Aspinall governor is extremely compact and simple. It is bolted to the air-pump lever, or, if desired, to a special rocking lever fitted for the purpose, and from there it is a simple matter to take a connection to the throttle-valve. It consists of a weight (**W**) mounted on a spindle parallel with, but a short distance from, its axis towards the lever. Therefore when the inertia of the mass due to the reciprocating motion of the lever is sufficient to overcome its weight, it will swing about this spindle at each stroke of the engine. But in so doing it causes either the top or bottom pawl, marked **P**, to swing outward, so that it strikes the lever **H** and closes or opens the throttle. Now, when the weight takes up its upper position the lower pawl swings outward and closes the throttle by pushing the lever upward, as shown dotted, and a small catch or detent holds the weight in this position until it is released by the detent striking the lever **H** as the governor swings downwards on its return stroke. If the engines have then resumed their usual speed, the weight will swing into its bottom position, and the top pawl will open the throttle on its next downward stroke; but if the speed is still above the limit, the weight will remain in its top position, keeping the top pawl in and the throttle closed.

The emergency gear comes into action in the case of a tendency for a very excessive race, such as losing a propeller or breaking a shaft. A smaller weight is then thrown upward which locks the larger weight in its top position and keeps the throttle shut.

The governor can be adjusted for small variations in the speed by means of the screws **S** and the spring **B**.

At first sight the action of this governor appears rather complicated, but it is simplicity itself when once understood. A good illustration of its action is to place a penny on the palm of one's hand and swing the hand up and down. When the speed is sufficient to cause the inertia of the penny to overcome the weight it is left behind, and the hand descends without it.

In conclusion, we would say that we have been on several ships fitted with this governor, and find that they work admirably. Even in a very rough sea the engineers are able to leave the throttling entirely to the governor whilst they attend to their usual duty.

Institute of Marine Engineers.—Monday, March 7th, paper by Mr. J. Lecoche (Member) on "Electro-magnetic Transmission of Power for Marine Propulsion." Friday, March 11th, Lawn Tennis Club Social Evening. Tickets on application to Mr. J. H. Redman, 1/6 each. Monday, March 14th, Discussion. Friday, March 18th, Annual Meeting at 7 p.m., when the annual report will be submitted and at which it is expected that Mr. James Denny (past-president) will occupy the chair. Monday, March 21st, Lecture by Mr. James A. Liddle, F.R.S.A., on "Improved Electrical Apparatus for Warping, Winding, Hoisting, etc., on board ship," with model and lantern illustrations. Monday, March 28th Discussion on Fuel Test. Monday, April 4th, lecture by Mr. E. Tate on "The Stability of Ships."

APPLICATION OF OXY-ACETYLENE WELDING FOR THE REPAIRS OF MARINE BOILERS AND HULLS.*

As one of the obligations of Membership is that of reading a paper before the Institute, it struck me that I could not deal with a subject which would be of greater interest to Marine Engineers than that of the Application of Oxy-Acetylene Welding for the Repairs of Marine Boilers and Hulls, inasmuch as this process has come very much more before the notice of Marine Engineers within the last two or three years than any other relating to boiler repairs. I understand that one of our Members read a paper before you bearing on this subject some two and a half years ago, but at that date very little had been done in this direction in this country. My excuse for pursuing the subject, however, at this date is the fact that big strides have been made since then; many of which I have been personally associated with.

The process of autogenous welding by means of the oxy-acetylene blowpipe dates back to 1901, when the use of compressed acetylene was made possible in this country by an Order in Council dated April 10 of that year, authorizing its compression into cylinders containing a porous material of fixed porosity. The high-pressure system was the first in use, and from this numerous low-pressure systems have been evolved. Autogenous welding permits the fusing of iron and steel without any previous heating up to thicknesses of 1 in. to 1½ in. in plates, and 4 in. to 6 in. in circular or rectangular pieces, without altering in any way their chemical composition, and yields, in the welded portion, a homogeneous metal which, in order to possess mechanical qualities similar to those of forged or rolled, only requires to be subjected to a forging operation or to a thermic treatment analogous to that which is employed in the case of steel castings and which may be carried out in a very simple manner by means of the blowpipe itself, which has already served to execute the welding. Metal may be added to the part to be welded in any desired quantity by means of a piece of steel or iron wire, which is fused in the blowpipe flame.

It will be gathered from the foregoing that an infinite number of applications are involved by this possibility of fusing iron and steel without altering their nature and of adding metal at will to any piece of work. It will be gathered that in marine boiler work, wasted landings can be built up, in any position, to their original state when worn by corrosion or when fractured; new pieces may be welded in to replace unserviceable parts in furnaces; pipe connections can be finished without joints; all kinds of receptacles of whatever shape can be made so as to be absolutely tight, and rivets in this connection can be dispensed with.

During the last few years a new process, that of cutting metals by means of an oxygen jet under pressure, has arisen to complete the new working methods inaugurated by the introduction of autogenous welding. By this process it is possible to cut plates ⅞ in. to 1¼ in. thick at the rate of about 30 ft. per hour, and pieces 8 in. to 12 in. in diameter in four or five minutes. This process has its special applications, such as demolition of metallic frame work, boilers, ships' hulls, etc., but in numerous cases it is a valuable auxiliary of autogenous welding, and permits of rapidly preparing a piece of work which has to be subsequently welded by means of the blowpipe.

We will now pass to the difference between the two systems employed in oxy-acetylene welding, that is, between the high and low-pressure systems. In the former case, in which dissolved acetylene is used, the two gases are both under pressure, the acetylene pressure being about 5½ lb. per square inch, and the oxygen being regulated to give the correct flame, the method of which will be shown later, when it will be noticed that although it has to be done by eye there is a strongly defined condition to arrive at.

In the manufacture of dissolved acetylene, before the gas is pumped into the cylinders it is thoroughly washed, dried

* Read before the Institute of Marine Engineers on February 21st, 1910 by Mr. Leonard M. Fox, Member

and purified; all impurities, such as phosphorus and ammonia are removed; and it follows that with this system a more reliable weld can be obtained. In relation particularly to repairs effected on board ship, the safety of this system as compared with the low-pressure one should not be lost sight of. This is a highly important point, as the confined conditions of a ship's stokehold do not admit of a low-pressure generator being introduced there without a great element of danger. With this system the adjustment of the flame is much easier than with the low pressure, as both gases are under better control, and once the adjustment is made it remains correct, even though the blowpipe tip should get partially blocked. A higher working efficiency is obtained on account of the intimate mixture of gases taking place. With both gases under pressure it is found in practice that great gas economy is obtained. Lastly, the plant being entirely portable can be taken anywhere; in fact can be taken inside the combustion chamber of a marine boiler and so placed out of the way of the workmen effecting repairs in the ship's stokehold.

of gas, an error in which, however slight, causes the flame to be either reducing or oxidizing, according to the excess or shortage of oxygen.

When acetylene is used with oxygen in a properly designed blowpipe it splits up into its component parts hydrogen and carbon at the base of the flame, carbon only taking part in the burning, due to the fact that hydrogen will not combine with oxygen at the temperature at which carbon will, consequently the hydrogen remains free and forms a protecting zone at the blowpipe tip where the carbon is burning. The high flame temperature obtained, combined with the fact that there is a zone of free hydrogen, renders the flame very reducing and extremely suitable for many operations which would otherwise have to be carried out by a more costly and probably less efficient method, and in some cases would be altogether impracticable.

From the foregoing remarks it will be gathered that the temperature of the oxy-acetylene flame is much higher than that of the oxy-hydrogen one, the former being limited by the dissociation temperature of carbon monoxide, whereas the

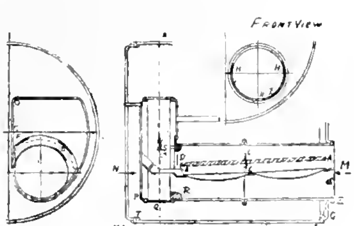


FIG. 1.

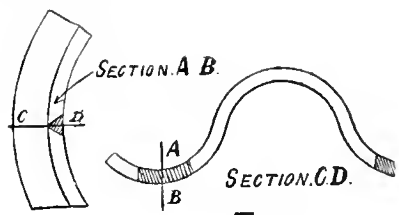


FIG. 2.

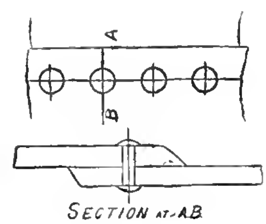


FIG. 3

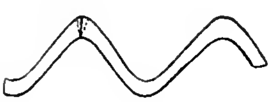


FIG. 4

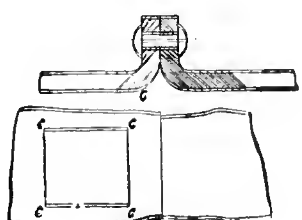


FIG. 5

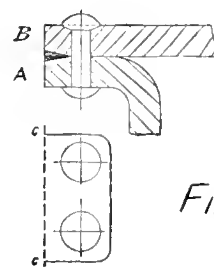


FIG. 6.

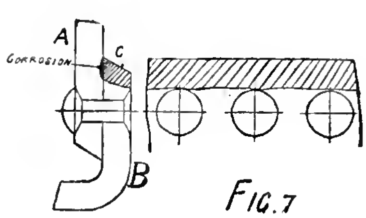


FIG. 7

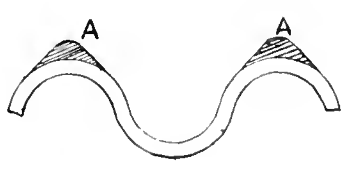


FIG. 8.

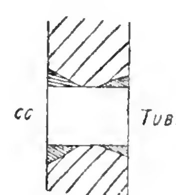


FIG. 9.

In the low-pressure system acetylene is drawn from a generator, and oxygen from a trade cylinder. The oxygen is used at about 15 lb. to the square inch, and draws the acetylene into the blowpipe on the injector principle. The intense heat generated by the oxy-acetylene flame, which is about 3,500° Cent., has been well known for years; but until a satisfactory method of storing acetylene was discovered, advantage could not be taken of the oxy-acetylene flame, which, up to that time, did not compare favourably with either the oxy-hydrogen blowpipe nor yet the electric method of welding. Nowadays it certainly does, inasmuch as an electric welding plant, even on the smallest scale, is very expensive and necessitates considerable capital outlay, the results are somewhat uncertain, the weld being almost invariably left brittle after annealing, and the working costs being very high. The oxy-hydrogen flame for this purpose has drawbacks which preclude its general use; amongst others may be mentioned the limits of temperature about 1,500° Cent., and the difficulty of judging the exact mixture

latter is limited to the dissociation temperature of steam.

The two processes just outlined (welding and cutting) render the greatest service to the ship repairing industry, more particularly in relation to the repair of marine boilers; in fact, they permit the execution of these repairs not only more economically than by any other process, but also more rapidly.

The very great importance of repairs to marine boilers by autogenous welding results from the following facts:—

(1) Repairs can be executed very quickly without prolonging the period of detention of the vessel, and they can further be effected during the time the vessel is obliged to remain in port for operations of unloading and loading cargo.

(2) Repairs by autogenous welding restore the part repaired to its original condition; consequently, by effecting the repair as soon as a defect is discovered, a boiler can always be kept in good condition, and it can be asserted that a boiler repaired methodically and regularly will have a much longer life than could otherwise be obtained. It will not become necessary

to replace it until it is worn out generally, when hitherto one has been compelled to condemn boilers when a part only was worn out, whilst the remainder was still in good condition.

(3) It happens frequently that the hull and boilers of old vessels do not reach simultaneously the degree of wear necessitating their condemnation. By the ordinary processes of repair one can quite well prolong the life of the hull by two or three years when the boilers are still in good condition, but it is not the same in relation to boilers. When these are worn out while the hull is still sea-worthy for some years to come, one is under the necessity to either condemn the vessel entirely or go to heavy expense for replacing the boilers, which will still be in good condition when the hull has to be condemned. Autogenous welding avoids this renewal during the last years of the life of a vessel.

The principal boiler repairs made possible by these processes are those rendered necessary by internal and external corrosions, wearing away of the landings by oft-repeated caulking, and lastly cracks. With reference to internal and external corrosions in furnaces and also cracks in the same, there has not been a great deal of this class of work undertaken in this country owing to the more or less sceptical attitude taken up by the various Classification Societies. There has, however, in Marseilles, Genoa, and Antwerp, been quite a considerable amount done successfully from time to time, and I am glad to note a disposition on the part of the Authorities in this country to allow these repairs to be undertaken here. Repairs under this heading can be successfully performed at quite a nominal cost, thus obviating in many cases the replacement of the furnaces in question, or alternatively the fitting of patches, which are, I think, admittedly a constant source of trouble to the Marine Engineer.

It may be well to mention here that welding by this process can be undertaken in any position, that is to say, it is possible to thicken wasted surfaces overhead if necessary; but needless to say for this special class of work it is essential it should only be undertaken by men with great experience. Whilst we are speaking of the inside of a boiler it will probably be as well to point out that any class of corrosion of the combustion chamber or furnaces can be successfully thickened, and in some cases corrosions or cracks arising in the tube plate at the tube ends can also be successfully treated. There is considerable difficulty, however, with this latter form of repair owing to cracks arising during contraction. In regard to repairs of corrosions of boiler fronts and shells, these of course are quite simple, and are effected at a very small cost. This equally applies to corrosions arising round manhole doors, the repairing cost of which is very small.

The applications of autogenous welding for repairing hulls of vessels are far more limited than those relating to boilers. They consist mainly in a series of minor repairs analogous to the work done in boilersmith's shop, and do not require very great skill. It should be noted in the first place that the materials used in ship building are much inferior in quality to those used in boilers, and consequently many repairs which can be effected on boilers will not be successful when dealing with inferior metal such as ship plates. Welding ships' frames, which is a fairly frequent occurrence, does not always prove successful unless the frames are liberated over a great length. Generally speaking the results obtained in this class of work depend solely on the quality of the metals to be dealt with. On the other hand there are small repairs of fairly frequent occurrence; for instance, repairing the corrosions on the hull, building metal on the outer edges of plates which are corroded, occurring frequently on the plates fixed on the stem or on the stern post, putting on new material on the rudder braces, and repairing all sorts of iron mountings.

In repairs necessitated by stranding or collision, welding permits of retaining a certain number of plates which can be restraightened and which only have unimportant fractures, generally at the rivet holes. This class of minor repairs can be successfully undertaken. In relation to stems and stern posts, autogenous welding permits of repairing them when fractured. With reference to stems which are always of relatively small section the work presents no difficulties. At the point of fracture an incision is made on both sides, the bottoms of the two incisions meeting in the middle of the thickness, and the welding is then undertaken from both sides simultaneously, new metal being laid on in successive layers. With reference to stern posts, they present of course greater difficulties by reason of their dimensions, but the same method is pursued in relation to these repairs with great success.

At this portion of my paper I should like to point out there are a few classes of repairs made possible by the process of autogenous welding in relation to the engine-room. As an illustration of these I will give you a pump cross-head. There has been undertaken successfully the building up of the journals of a pump cross-head even to as large an extent as welding on ½ in. of metal. The cross-head in question was then taken to the lathe and re-turned to the original diameter of the journals. This class of repair can be carried out on almost any journals such as winch shafts, windlass shafts, etc., and in such cases, it is quite possible to make the journals equal to those to be found on a new shaft.

Another branch of the autogenous welding industry is that of burning out rivets. For this purpose a cutting jet is brought to bear on the rivet head, which is quickly melted, and the rivet is then driven through. It is possible to burn rivets out with a blowpipe jet consuming 600 litres, given a rivet of ordinary dimensions at a speed of 100-120 per hour. For the purposes of illustrating some of the common forms of repairs referred to in this paper I will now show you a number of lantern slides prepared in relation to repairs executed recently in this country and on the Continent.

Fig. 1 shows a furnace of the current type from which our examples generally will be taken. Corrosion often takes place on the line a little above the firegrate, and has a width of from 4 in. to 8 in., this can be seen at *AA* (Fig. 1). To repair this form of corrosion the plate must be thoroughly cleaned of dirt and scale and then built up to the original thickness by adding metal in one or more layers, according to the amount required to arrive at the original thickness.

Fig. 2 shows another common type of defect in furnaces, namely, cracks; these occur most frequently in or about the same region as corrosion; this work is done from the inside of the furnace, and during the execution of the same it is found that far more cracks develop than were originally discovered. As the cracks in question start from the outside of the furnace, they only become apparent from the interior on heating up.

All this class of repairs are first cut open to a V shape and then filled in by introducing new metal. A common method used for temporarily remedying this defect is of course caulking and patching, both of which methods are distinctly unsatisfactory. Cracks in boilers are of course found in almost any situation; the most frequent ones besides those already referred to are (*a*) cracks issuing from rivet holes (Fig. 3) extending to the edge of the plates—repairing of these does not present any difficulty; (*b*) vertical cracks which form principally in furnaces with ribs (Fig. 4). Through the depth of the ribs the repair of these is rather difficult on account of their situation, and also owing to the thickness of the ribs, which of course gives unequal expansion and contraction. In order to facilitate this class of repair it is better to heat the ribs with a blowpipe from the interior of the boiler, while the welding is done from the interior of the furnace. (*c*) Vertical cracks—*CC* (Fig. 1)—in furnaces of plain plate made up in sections vertically. It should be noted (Fig. 5) that after having welded up these cracks it is necessary to take up the rivets which join the two sections of the furnace; this sometimes presents great difficulties owing to the nearness of the furnaces to each other, or to the boiler shell, one is led in that case to cut a hole in the crown inside of a furnace as desired, in order to gain access to these rivets, and after having taken them up, to weld the piece in again. This operation has been carried out repeatedly.

In all systems of furnaces fractures are found very frequently at *D* (Fig. 1) at the back end or flange by which the furnace is fixed to the tube plate; as you are very well aware this part is under great strain owing to the expansion and contraction of the furnace. The repair of these fractures presents no particular features, but this part of the furnace frequently exhibits other damage resulting from corrosion or from wear by caulking, and instead of contenting oneself with welding up a crack, one is frequently led to cut away the whole bad piece and weld in a new piece to replace it. This course commends itself, in particular, in old boilers where cracks of this kind have been covered over by a riveted patch; the plate of the furnace in that case is cut up by a large number of rivet holes, and frequently eaten away by corrosion caused by leakages arising continually with such riveted patches.

Fig. 6 shows the front end of a furnace riveted to the front

plate of a boiler. This joint is under great strain from expansion and contraction, hence arise leaks which corrode the plates and necessitate caulking, which shortens the landing by about $\frac{3}{32}$ in. every time it is done, and consequently this landing has after a time to be built up again. The best way to execute this repair if there are corrosions in the part *A* is to cut away a piece— *CC* of the furnace plate *B*—repair plate *A*, then weld in a new piece *CC*.

have become loosened by this operation are removed. The flange *C* is set to bear hard on to *A* and the rivets are replaced. In some cases the rivets are removed before carrying out the repairs.

Fig. 8 shows a plate thickened up ready for insertion in a furnace with thickened-up ribs, where it has been found necessary to replace a bad part from corrosion or from numerous cracks in a small area, when it is often found better to replace

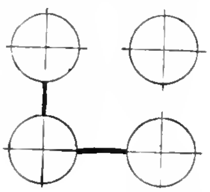


FIG. 10

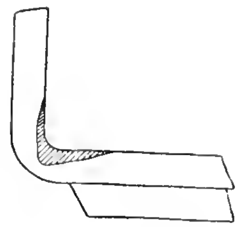


FIG. 11.

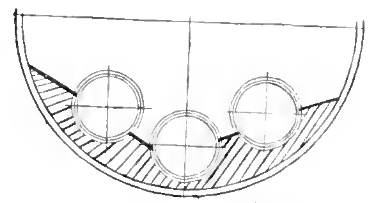


FIG. 12.

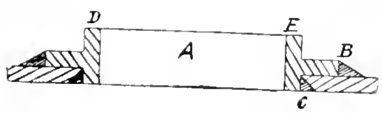


FIG. 13.

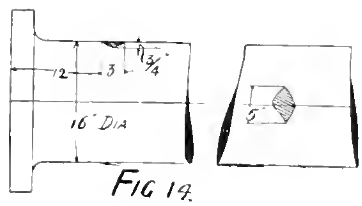


FIG. 14.

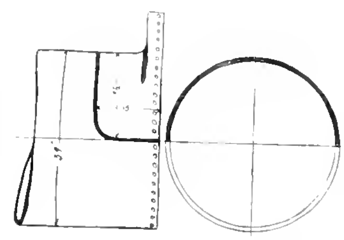


FIG. 15.

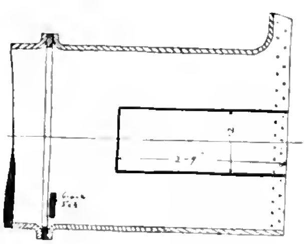


FIG. 16.

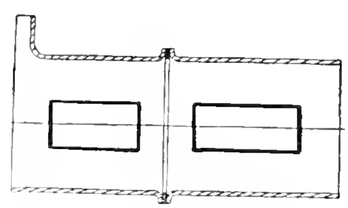


FIG. 17

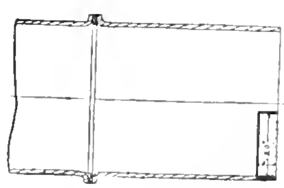


FIG. 18.

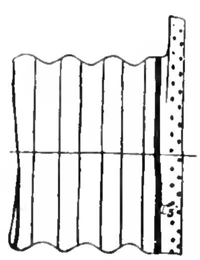


FIG. 19

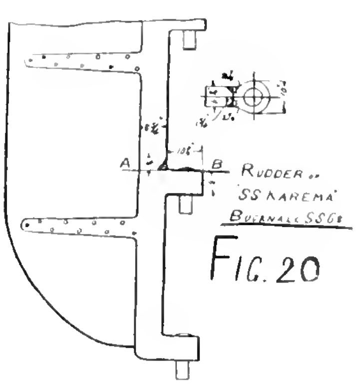


FIG. 20

Another source of leakage is in the joints at the combustion chamber end of a furnace. These defects usually occur in the part *F* (Fig. 1) and appear as shown in Fig. 7. The plate *A* gets corroded through leakages, and the landing of plate *B* gets reduced through caulking. The corrosions in *A* are first repaired, then metal is added on to *B* to restore the landing *C* to its original depth. Care must be taken not to weld it in with plate *A*, as this will give a very bad result. The rivets which

the whole affected part than to repair by the method already described. It is sometimes desirable to replace a whole furnace. This can be easily done by cutting the old one out with a cutting blowpipe. A new furnace is prepared in three or four pieces, put into place, and bolted up firmly, then the various pieces are welded together, when a new furnace is formed identical with the one removed as to dimensions, and presenting the advantage of not having any riveted joints.

Combustion chambers are subject to the same defects as furnaces, such as corrosions and cracks.

In Fig. 1 are shown several repairs to a combustion chamber; these were carried out on the s.s. *Marsa* and are as follows :—A patch *P* was inserted at the back—a piece *Q* of the bottom plate and two pieces *E* and *S* on the landing at the bottom of the furnace and on the tube plate flange respectively (each of these pieces being about 20 in. wide and 3 ft. long) were inserted.

Fig. 9 shows a tube plate corroded through leakage at the tube; these corrosions are usually found on both sides of the plate, but are more pronounced on the combustion chamber side. These corrosions can be repaired by autogenous welding fairly successfully, thus avoiding great expense. In repairing these corrosions a sheet of metal should be put over the far end of the tubes to prevent a draught being set up, otherwise the repair would be almost impossible.

In the tube plates cracks arise, extending from one tube to another, as shown in Fig. 10. These cracks are very difficult to weld up because they are in the very place where the width of solid plate is least, and the full effect of contraction is brought to bear on this line; these cracks, fortunately, do not often occur.

Fig. 11 shows the corrosion at the point *T* (Fig. 1) of a boiler. This repair was executed on the boilers of the *Marsa* at the same time as the repairs to the combustion chamber referred to above. These corrosions take place at the bottom of both front and back plates, especially in badly kept boilers, where they always occur, and have frequently been repaired. External corrosions of the front plate of a boiler are caused through leakages or by the action of bilge water or wet ashes adhering to the boiler. Ordinary corrosion at the joints are treated as pointed out in Fig. 9. Sometimes, however, it is found advisable to replace a portion of the front plate. This is shown in Fig. 12, the two pieces are strongly jointed together by the furnaces and the welds are very short. In the ordinary course these corrosions should be repaired by building up. The joints of man-holes and mud-holes after about six months are usually leaky. This leads to corrosion, which in time makes it impossible to get a tight joint. These can easily be repaired by welding metal on to bring the joint up to its original height. When the corrosions are very bad, a piece *A* welded to *C* and *B* may be put on, as shown in Fig. 13. The joint of the cover is made at the surface D, E.

In Fig. 14 is shown another repair to the *Marsa*; the tail shaft was rejected because it contained a flaw, as shown. This was welded up and passed, thus obviating the expense of a new shaft. To weld a job like this it is necessary to get the parts to be welded up to a red heat with a coke fire before starting on the repair. One—sometimes two—blowpipes, consuming about 90 ft. of acetylene per hour each have to be used on this large work

Fig. 15 shows a new furnace which was cut, as shown, to enable it to be put into place; it was then welded up, being as good as before cutting.

Figs. 16, 17 and 18 show badly corroded or cracked places in furnaces repaired by means of welded patches in place of building up or filling in; this is the best method of dealing with these defects when they are very bad. Fig. 19 shows a furnace which was cracked almost all round the neck; it was welded completely round and was as good as new.

Fig. 20 shows a repair effected on the rudder of the s.s. *Karem* recently undertaken in Glasgow. It will be observed that two cracks or rather deep corrosions have taken place in this particular rudder, and they were successfully repaired in the space of about four hours.

Fig. 21 shows repairs being effected on the stem of a French steamer which should prove interesting. In the lower portion of this stem will be noticed a weld completed, while higher up the men are actually working on another joint. It may be pointed out that the piece between the two welds is a new one entirely.

Figs. 22, 23, 24 and 25 show pretty clearly the method of working adopted in furnaces, both overhead and otherwise. This work was carried out on the s.s. *Oxus* belonging to the Cie des Messageries Maritimes, in Marseilles, and is the most important Continental work undertaken up to the present time. It comprises the replacement of eighteen furnaces by furnaces made in sections and welded together. In addition to this all the corrosions existing in the interior of the six boilers were repaired, together with a large number of corrosions, cracks, etc., in the tube plate.

I should like to point out to you that cast iron can be welded with a fair degree of success, but one is never certain how a particular casting is going to turn out, and it is not advisable to risk this method of repair where strength is needed, unless a good surplus of metal can be added and left on the weld. Copper can also be welded, but the cost is a great deal higher than that of welding steel owing to its high conductivity blowpipe of about twice the consumption having to be used on a blowpipe plate as against the same thickness of plate in steel. With reference to repair of aluminium, welding has been tried, and in a few cases has been successful, but it has been found that soldering is the best method of employ, the main reason being that the work has not to be heated to such a high temperature as for welding, consequently the risk of cracking or distortion whilst cooling is greatly lessened; this soldering makes the repaired part almost as strong as it originally was.

I have heard it suggested by several gentlemen interested in this class of work and associated with the shipping industry, that the time is not far distant when a small welding outfit will be considered a necessary adjunct to the equipment of a marine engine-room, just in the same manner as an anvil or a portable forge. There is no doubt that there are several classes of minor repairs which can be successfully dealt with by this method, with an engineering staff of average intelligence.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondent*).

Portsmouth Dockyard.

THE new battleship *Orion* is making very satisfactory progress, but the order as to secrecy is still being observed, and not even naval officers are allowed near the slip unless they are on special duty. It is, however, understood that some new features are being introduced into the vessel. Every effort is being made to hasten construction and it is practically certain that the ship will be launched by the end of June or the beginning of July. This will allow of a new battleship being commenced in the late summer or early autumn. All departments are now working at high pressure, and extra men have been entered to complete work by the end of the financial year, including that on board the *St. Vincent*, which is to be commissioned for service in the First Division of the Home Fleet towards the end of March. It was at first said that the *St. Vincent* would relieve the *Dreadnought* as flagship of Admiral Sir William May, so that the latter vessel might have a refit. The Admiral, however, prefers to retain the *Dreadnought* as his flagship, and she will only have necessary defects made good. The battleship *Jupiter*, which has had an extensive overhaul, has rejoined the Third Division of the Home Fleet. The refits of the cruiser *Good Hope* and the battleship *King Edward VII.* are being pushed on, and several destroyers are also in hand, as is also the repair ship *Hecla*. The latter vessel, it is interesting to note, was once a Transatlantic passenger ship named the *British Empire*, but no one would think so to look at her now. She is practically a floating dockyard for thirty to forty destroyers, and there are few casualties likely to occur to those craft that she cannot readily deal with. The gunboat *Drudge* bumped against one of the blocks of Spithead Breakwater when coming into harbour recently, and has been placed in dock for her injuries to be made good. Now that one of their own vessels has come to grief on the breakwater, the Admiralty may perhaps provide the additional opening nearer the shore which owners of local craft have been asking for. The two new destroyers of the River class which the Admiralty have purchased have been named the *Test* and *Stour*. They are to be commissioned at this port for service in the Second Destroyer Flotilla. Preparations are being made in Fountain Lake for the new floating dock, which is to be placed there. Dredging is going on, as a great depth of water will be required for sinking the dock to enable a battleship to be floated into it. Engineer-Captain Adams, who is on the staff of Rear-Admiral Brock, commanding the local division of the Home Fleet, has been awarded a good service pension of £150 a year. An explosion, due to the bursting of a boiler tube, occurred in the *Fisgard*, the depot

for boy artificers, on Feb. 10th, five men being scalded, one of whom subsequently died.

Devonport Dockyard.

The whole of the auxiliary armament of the battleship *Collingwood* has now been placed on board, and, with the exception of the wireless apparatus, which is daily expected, the fighting equipment of the vessel is complete. Good progress is being made with the construction of the cruiser *Indefatigable*, which was commenced a year ago and launched in October. The boiler installation is in place, the boring out of the main propeller shaft bearings is practically complete, and the adjustment of the metal castings is in hand. The 30-ton rudders are, as regards their main structure, complete. The armoured cruiser *Defence* has been placed in dock for the purpose of having her underwater fittings examined and the sights and fittings of her main armament tested. The refit of the cruiser *Highflyer*, for which over £45,000 has been provided, deals with practically all the more important parts of the vessel's complement. The steam department is undergoing thorough overhaul, the electrical equipment is being modernized, the magazine cooling appliances are being opened out, and all the armament fittings are receiving attention. The armoured cruiser *Warrior* arrived on February 10th from Portland to be docked for refit. The sloop *Espiegle*, which is being prepared for service on the East Indies station, will when completed be one of the best equipped vessels of her class, as she is to have as part of her new outfit wireless telegraphy and refrigerating and other cooling machinery. The *Espiegle*, which was practically a hulk when taken into dockyard hands, will be the first vessel of her class to be provided with wireless at this yard. The improved equipment of the coal hulk *Himalaya*, which has been in hand for several months, is now finished. The destroyer *Erne* has come in for repair, a collision having occurred between that vessel and the *Moy* on the return of the Second Flotilla from tactical exercises. The *Moy* did not suffer any particular injury, but the bows of the *Erne* were damaged. An examination of the bottom plating of the destroyer *Express* has disclosed defects in several of the plates, and the work of removal and replacement has been taken in hand. Two other destroyers, the *Starfish* and *Sturgeon* have been found to be much worn and decayed, and it has been decided to withdraw both vessels from service. It is expected that they will be placed

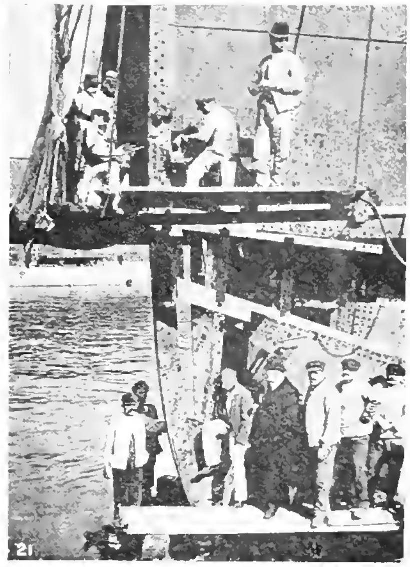


Fig 21

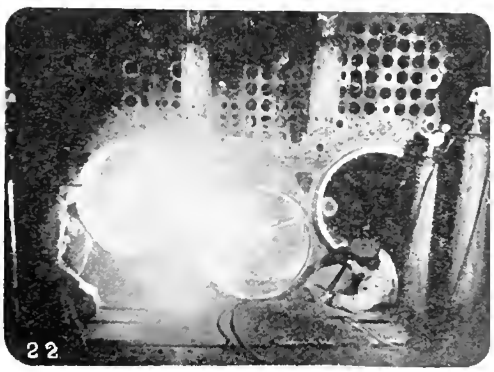


Fig 23


Fig 22

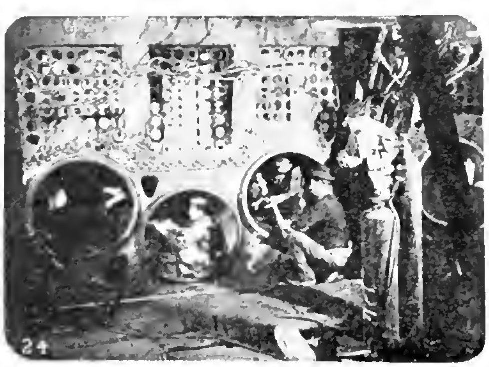


Fig 24

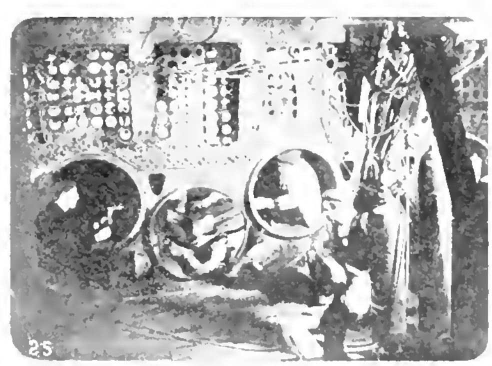


Fig 25

See—" Application of Oxy-Acetylene Welding for the Repairs of Marine Boilers and Hulls, page 30[illegible]

on the next sale list for disposal. Submarines *B.5*, *B.7*, and *B.9* are undergoing a thorough overhaul, and the remaining vessels of the Western Division will shortly come in for similar treatment. After a voyage of over a week, the old hulk *Tenedos III.* has arrived here from Chatham in connection with the transfer of the boy artificers' training establishment from that port. She is to be taken in hand in order that the necessary alterations may be made. The *Tenedos* is one of several vessels built to the order of the Government of India. She is built of oak and teak and is in a remarkably good state of preservation.

Chatham Dockyard.

Several of our big refits have been completed, including our largest job of the year, the battleship *London*, which has been re-commissioned to relieve the *Albemarle* as flagship of RearAdmiral Sir Colin Keppel in the Atlantic Fleet. The battle squadron of that fleet is now composed of six sister ships, the *London, Prince of Wales, Formidable, Implacable, Venerable* and *Queen*. The *Prince of Wales*, the flagship of Vice-Admiral Prince Louis of Battenberg, which has been undergoing her annual refit, is also out of hand. The battleship *Irresistible* has completed refitting and has gone to Portland to resume her duties in the First Division of the Home Fleet. Another vessel to be completed is the cruiser *St. George*, which has undergone extensive alterations to fit her as depot ship of the Nore Destroyer Flotilla. The cruiser *Blenheim*, the depot ship of the First Destroyer Flotilla, is to be out of hand by March 12th. The *Topaze*, the depot ship of the Portsmouth Destroyer Flotilla, has arrived for a refit, and the cruiser *Sapphire*, which has been relieved in the Second Destroyer Flotilla by the new cruiser *Bellona*, is to be taken in hand on March 1st for a refit, which is to be completed by the middle of April. The *Indomitable*, the flagship of Rear-Admiral the Hon. S. Colville, which was placed in dockyard hands at the end of December for a refit, is to rejoin the First Cruiser Squadron early in March, and the *Shannon*, the flagship of Rear-Admiral Lowry, will resume duties in the Second Cruiser Squadron about the same time. Torpedo Boat No. 0 has completed her refit and has rejoined the Nore Flotilla. Seven of the Nore Destroyer Flotilla are undergoing a refit, the *Conflict, Earnest, Griffon, Lively, Teazer* and *Eden*, but the first six will all be out of hand before the beginning of March. The last to arrive was the *Eden*, which was seriously damaged at Dover. The scout *Attentive* is also having an overhaul, and she is to be finished by the end of the first week of March. The refit of the repair ship *Cyclops* has been completed, and she has gone to Portland to resume duties with the First Division of the Home Fleet. The battleship *Africa*, of the Second Division of the Home Fleet, has come in for a refit. *C.20*, the fourth submarine built and equipped at this yard, has been completed and has gone to Dundee to join Section VII., which is based at that port, and now consists of twelve vessels of the "*C.*" class. The battleship *Ocean* has joined the Fourth Division of the Home Fleet at this port. The whole of the six vessels of the *Canopus* class have now been withdrawn from active service. The *Vengeance* is tender to the Chatham Gunnery School and the *Albion, Canopus, Glory, Goliath* and *Ocean* are in the Fourth or Reserve Division of the Home Fleet at the Nore. The ships are by no means old, their period of efficiency from the date of completion having been less than ten years. A steel mooring and salvage lighter is to be built here for service at Sheerness. The lighter will have the latest salvage fittings, and will be capable of lifting submarines of the "*C.*" class. The *Tenedos III.*, the depot for the training of boy artificers, met with a mishap while being towed round to Plymouth. She broke away from the tugs in the Channel close to the South Foreland, and it was necessary to summon the aid of the battleship *Formidable* from Dover. The battleship escorted the *Tenedos* to Spithead, and the latter vessel afterwards went on to her destination. The removal of the old hulks from the basin will provide much needed room for vessels which come in for refitting.

Sheerness Dockyard.

What might have been a serious disaster occurred to the destroyer *Eden*, which left here with the scout *Patrol* and five destroyers of the Nore Flotilla on January 26th for exercises. The vessels proceeded to Dover and next evening the *Patrol* and three of the destroyers left there for night operations, leaving the *Eden* and two other vessels in the naval harbour. A gale sprang up and about two in the morning the *Eden* parted from her moorings and was driven toward the sea wall of the East Cliff. Signals were made, but before help could be given the destroyer was driven in across the rocks. The coastguards fired a line across the vessel, and in about half an hour her fifty-three officers and men were safely taken off. Arrangements were made at once for the salvage of the *Eden*, and anchors and hawsers were used to prevent her capsizing. As the tide ebbed the vessel was left high and dry, and it could then be seen that her bows had been split, her propeller blades stripped, her rudder twisted, and her hull pierced. Salvage parties from the battleship *Albemarle* and the cruiser *Venus* proceeded to get out the guns and ammunition so as to lighten the destroyer. In spite of all precautions, the *Eden* grated badly against the sloping granite, and it was decided to let her fill with water, but she was refloated at high tide and next day was taken into Dover Harbour, where she was temporarily repaired. She was towed round to Chatham on February 11th for repairs. The torpedo gunboat *Leda*, which left last month, after having made good the damage received to her decks during a gale in the North Sea, put back from Grimsby for repairs. They, however, did not take very long, and she left about the middle of the month to resume fishery and coastguard duties. The torpedo gunboat *Hazard*, which is refitting for service as a submarine depot ship, has had lifted into her two water tube boilers similar to those fitted in destroyers of the *Ariel* type. Over £19,000 is to be spent on the vessel. The ocean-going destroyer *Crusader* has resumed duties in the First Destroyer Flotilla at Harwich, on completing her refit, and the *Rother*, which had been in hand for several weeks, has also rejoined the pennant of Commodore Charlton. The *Wear, Usk, Ure* and *Teviot*, of the same flotilla, have come in and have been placed in the steam basin for their annual refit. The *Wear*, which also had a new slide valve fitted, has left to resume her duties. Submarines *C.1*, *C.3* and *C.4*, of Section III. Flotilla, have completed their refits and returned to Harwich.

Pembroke Dockyard.

The cruiser *Bellona*, having been passed as "all correct," left us on February 1st and proceeded to Devonport, where a week later she was commissioned to replace the *Sapphire* as the ship of the captain in command of the Second Destroyer Flotilla. The construction of the *Bellona* occupied nineteen months and a half, and her cost, including £5,480 for guns, was about £284,599 which is about £47,480 less than her predecessor, the *Boadicea*. The difference is mainly as regards the main turbine propelling machinery, which, although of the same horse power and similar in design, cost £168,727 for the *Boadicea* and only £121,741 for the *Bellona*. With regard to the cruiser *Blanche*, the turbines have not yet been delivered, but the boilers are all on board and in position. There will be no cruising turbines in the propelling machinery such as were placed in her sister vessels the *Bellona* and *Boadicea*. Our other vessel, the cruiser *Blonde*, has been framed from stem to stern below the lower deck, and all the main bulkheads and principal structural details in the interior are in place. The launch of the vessel, it is understood, has been provisionally fixed to take place during the second week in May. The working staff on the ship has lately been augmented by two gangs of shipwrights withdrawn from the *Blanche*. Three torpedo boats have arrived here to form the nucleus of a flotilla which is to be based at this port. Although not adding materially to the defences of Pembroke, the arrival of the boats would appear to point to the fact that the Admiralty realize the necessity of improving the defences of the Bristol Channel, and that Milford Haven is looked upon as being the most advantageous situation for a base. Many here are of opinion that important developments are probable before very long. An examination of one of the slipways in the east of the yard, the dry dock, and No. 1 Slip, has recently been made and measurements taken. It is anticipated that a basin for the accommodation of torpedo boats and other small craft, an extension of the dry dock, and the utilization of the slip for the purpose of laying down a larger ship than has been built here for the last five years, are in contemplation. It is to be hoped that such will be the case.

MARINE BOILER EXPLOSIONS.

From the Board of Trade Reports.

REPORT No. 1870 deals with the explosion from the boiler of the steam drifter *Hilda*. The explosion occurred on the 25th April last. No person was injured by the explosion. The boiler, which is made of steel, is of the ordinary cylindrical, multitubular, single-ended, marine type, and is fitted with two plain furnaces. The explosion occurred from a small hole in the shell plate of the boiler, at the bottom, in way of the after bearer. The plate was locally wasted internally at the part which gave out, where the plate had been reduced from the original thickness to practically nil. The observations of the Engineer Surveyor-in-Chief are as follows:—The explosion in this case was not of a serious character. It would appear that the shell plate was locally corroded to such an extent that, under ordinary working conditions, a small hole was formed through which water escaped from the boiler; but, fortunately, no difficulty was experienced in maintaining the usual water level while steaming to a position of safety.

Report No. 1891 deals with the explosion from the boiler of the steam trawler *Strathallan*. The explosion occurred on the 28th October last, when the vessel was about two miles north-east of the entrance to Aberdeen Harbour. No person was injured by the explosion. The boiler is of the ordinary single-ended marine type, and is made of steel. A portion of the jointing material of the lower manhole door was ruptured and forced out, thus leaving an opening through which the contents of the boiler were discharged into the engine-room, the pressure at the time being about 140 lbs. per square inch. The explosion appears to have been due partly to the fact that the asbestos jointing ring used was too small for the door, so that it had been necessary to stretch it considerably in order to get it to pass over the spigot, thereby weakening the material. It is also probable that the nuts by which the door is secured were insufficiently tightened when the bottom of the boiler became hot. The observations of the Engineer Surveyor-in-Chief are as follows:—The explosion in this case was of a minor character, but it shows the necessity of jointing material for manhole doors being of a suitable size, and also the necessity for the manhole door to be thoroughly tightened up at frequent intervals during the process of raising steam and when the circulation of the water in the boiler has become such that the water is heated throughout, which naturally tends to soften the jointing material.

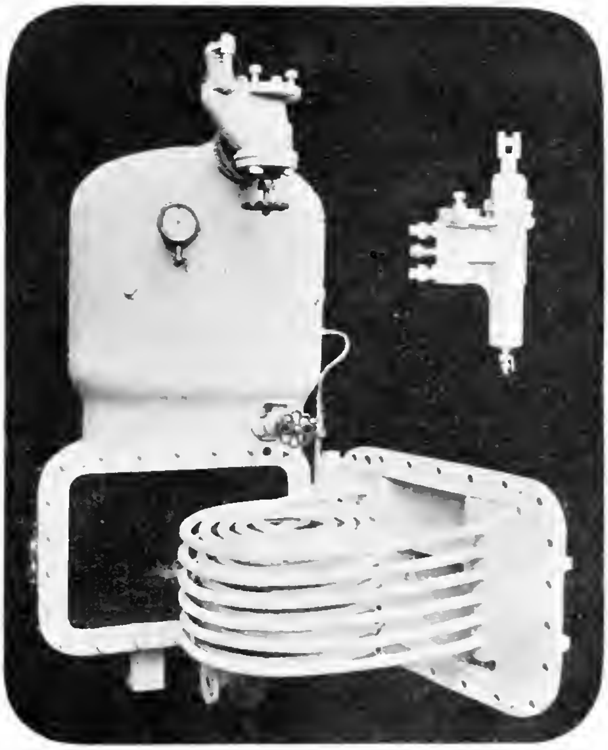
Report No. 1802 deals with the explosion from a main steam pipe on board the s.s. *Frankland*. The explosion occurred on the 17th November last. No person was injured by the explosion. The pipe was made of solid-drawn copper and was 5½ inches in diameter internally, 4 B.W.G. in thickness, and about 12 ft. in length; the ends being fitted with brass flanges, brazed on in the usual manner. Steam was seen to be escaping from the pipe, and, on examination, a circumferential fracture, about 2½ inches in length, was found at the neck of the flange which joined the pipe to the boiler stop valve. The explosion was due to the want of sufficient elasticity in the pipe to allow for the movements between the engines and boiler. The observations of the Engineer Surveyor-in-Chief are as follows:—This report has reference to the failure of a copper steam pipe, apparently owing to the inadequacy of the provision for taking up the movements under working conditions, but fortunately the consequences were not serious.

Report No. 1803 deals with the explosion from the main feed check valve of the steam drifter *Lily*. The explosion occurred on the 30th September last, when the vessel was at sea. No person was injured by the explosion. The cover of the feed check valve was blown off by the pressure of steam in the boiler, thus permitting the escape of boiling hot water and steam into the engine-room. The threads of the screwed parts of the cover were not a good fit into those of the valve chest, the cover apparently being only held by the tips of the threads, and these having become somewhat worn the cover was no longer able to resist the pressure in the boiler and it was blown off. The observations of the Engineer Surveyor-in-Chief are as follows:—The cover of the feed valve referred to in this report was screwed into the top of the chest, but appears to have been too small and was held only by the tips of the threads. These having become worn, the cover was unable to resist the pressure in the boiler, which at the time of the explosion was 60 lbs. per square inch, and it was blown off, the contents of the boiler being discharged into the engine-room. The explosion was of a serious nature, having regard to the diameter of the opening and the pressure in the boiler, and the men engaged in the engine-room at the time are fortunate in having escaped injury.

AN IMPROVED EVAPORATOR.

A VERY interesting type of evaporator has just been placed upon the market by the Central Marine Engine Works of West Hartlepool, and which is illustrated herewith. The difficulty attending the use of an evaporator on board a vessel intended for long sea voyages is too well known to need description, and the apparatus which is here described is intended to get over the difficulties which have been found in practical operation.

In the "CMEW" evaporator the copper coils are shaped (as shown in the illustration) in such a manner that they expand and contract to a very considerable extent, and this has the advantage that the scale is



thereby released and allowed to fall through the nest of coils owing to their arrangement with respect to one another. In this way the evaporator is enabled to supply all supplementary feed water to the boilers required for a long voyage without having to be opened up for scaling. In order to meet any possibility of the evaporator becoming choked on an unusually extended period, further provision is made by attaching the tubes to a hinged door which can be readily swung out and the tubes scaled if necessary.

The coils are attached to the door by means of long-tapered ends and brass nuts, situated in the steam spaces, so that individual coils can be readily removed without disturbing others in the event of their failure. When the valves are once adjusted the evaporator works so steadily as to require no further attention for three or four hours.

In order to encourage good circulation the highest pressure steam is led into the centre of the coil and returned on the outer side, and a very rapid generation of steam thus results. The main body is enlarged so as to give a great amount of ebullition surface and steam space, which, together with the efficient baffling arrangement enables vapour, free from salt, to be produced. The water gauge is arranged to take a standard size of boiler gauge glass so that one slock will do for the boilers and evaporator, and a pointer is fixed to the evaporator to indicate the correct working level. In order to make provision for the possibility of a leaky joint an independent door is fitted so that the coils may be inspected for a leak while full steam pressure is on.

It will be seen that this apparatus goes very far to attain the complete requirements on board an ocean-going vessel. The Central Marine Engine Works are also developing a strong line of boiler feed and ballast pumps of the vertical duplex double-acting type.

RAINBOW PACKING.

THIS packing, which has had considerable success in the United States of America, is now being put upon the market in Great Britain by Messrs. Carr Brothers, Ltd., of 11, Queen Victoria Street, London, E.C. The packing, which has been patented and is manufactured by the Peerless Rubber Manufacturing Company, of New York, is specially adapted for very high pressure, and is not affected by any degree of steam heat. It is claimed that it will not harden under any degree of heat or blow out under the highest pressure, and will make an air, steam, hot or cold water joint equally well. Further, it is not affected by oils, ammonia liquors or alkalies, and, unlike plumbago and other similar sheet packings, will not harden or crack. An important characteristic of the Rainbow Packing is that joints can be made and broken in a mere fraction of the time consumed with packings that harden, for the reason that a tool is not required to break or face up the joint. In addition to this jointing material a rubber sheet packing with wire insertion is also manufactured, together with various forms of gasket and rod packing, as well as many other articles of a similar nature for jointing purposes.

NEW DREDGER FOR THE BRITISH ADMIRALTY.—Messrs. Wm. Simons & Co., Ltd., Renfrew, have received an important order from the British Admiralty for a 2000-ton "Simons" suction cutter hopper dredger. This vessel will be able to dredge its own flotation by means of a cutter in front of the suction pipe and up to a depth of 60 ft. of water. This type of dredger is an evolution of the suction cutter dredgers *Jinga* and *Kalu*, constructed recently by Messrs. Simons and Co., Ltd., for the Sewri Reclamation Scheme at Bombay. In placing this new order the Admiralty have been greatly influenced by the satisfactory work done by the Bombay dredgers.

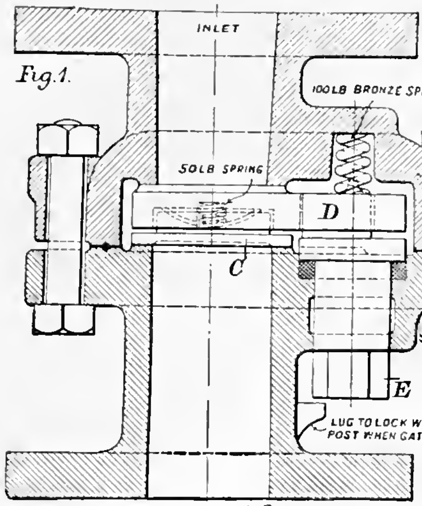
HIGH-PRESSURE BLOW-OFF VALVE.

THE difficulties and inconveniences associated with blow-off valves, particularly in high-pressure boilers, are well-known to those whose duty it is to deal with boiler installations, and any modification in design which will materially reduce the well-known objectionable features will be welcomed by all who have to deal with these appliances in the matter of every-day life.

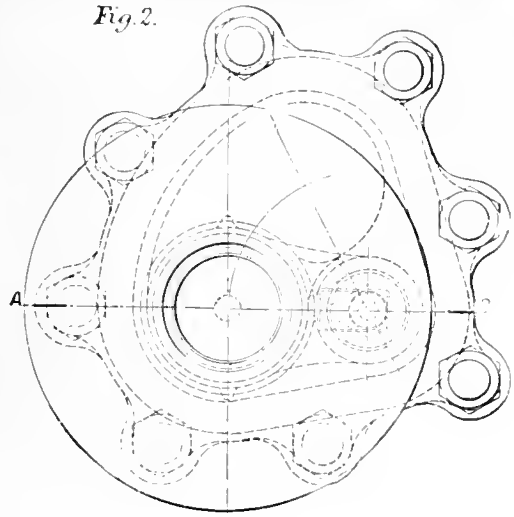
With a view of getting a device which is not only strong in construction and simple to manufacture, but at the same time will give full way for the water or steam, a novel design of blow-off valve has been produced by Mr. Patterson, of the Patterson Allen Engineering Company, of New Jersey, United States of America, which we illustrate in the adjoining diagrams. These illustrations are sufficiently comprehensive in character to render any detailed description unnecessary.

It will be seen that Figure 1 is a sectional elevation of the valve. Figure 2 is a plan. Figure 3 is a plan of the valve and seating, and the upper part of the case removed, while Figure 4 illustrates perspective views of the various parts of the device dissociated from one another. The general feature of the device comprises a faced disc C adapted to slide over a seating by being operated from an internally-disposed pivoted arm, controlled by operating means situated outside the casing. At the end of the arm D a recess is formed, into which the face disc C is inserted, a small spring being adapted to maintain the valve against its seating, while the back of the arm slides along a face in the upper portion of the casing situated immediately over it.

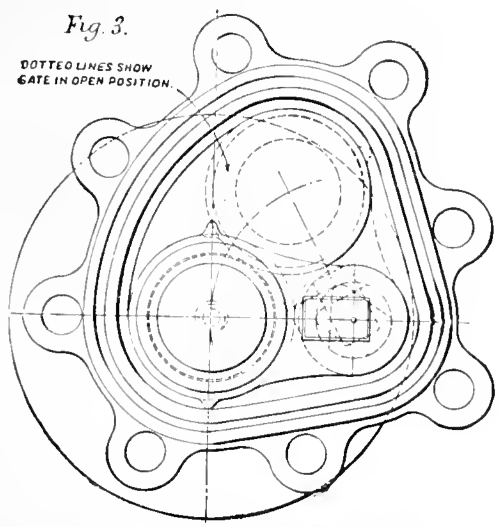
The valve is operated by means of a spindle E which projects through the lower casing, and has its external part adapted for receiving a spanner. It will be noted that no stuffing-box and gland is provided, but a collar on the spindle bears upon a layer of packing, and is held on the same by means of a spring. We understand that such a joint keeps perfectly tight under ordinary circumstances, and has the advantage of requiring no attention. Owing to the particular shape of the casing, the valve, when in its open position, has its surface protected by the recessed portion of the case, situated out of the path of the water or steam through the valve casing, and, owing to the fact that the spring always presses the valve down, away from the arm, no grit can get under it when in such open position. The upper part of the device is of taper formation, so as to form a nozzle which directs the steam of fluid into the discharge pipe, and prevents any scouring of the valve seat, while a cleansing action is set up owing to the inductive effect produced by the stream of fluid. We understand that a two-inch valve under a pressure of 200 lbs. per square inch can be moved by an eight-inch lever on the application of about 25 lbs. strain, which is much less an amount than is usually necessary with blow-off plug cocks of ordinary construction under similar conditions. These valves are put on the market in this country by Messrs. Wallach Brothers, Limited, Finsbury Square, London, E.C.



SECTION AT A.B.



VIEW FROM INLET END.



TOP BONNET REMOVED SHOWING GATE & WORKING FACE.

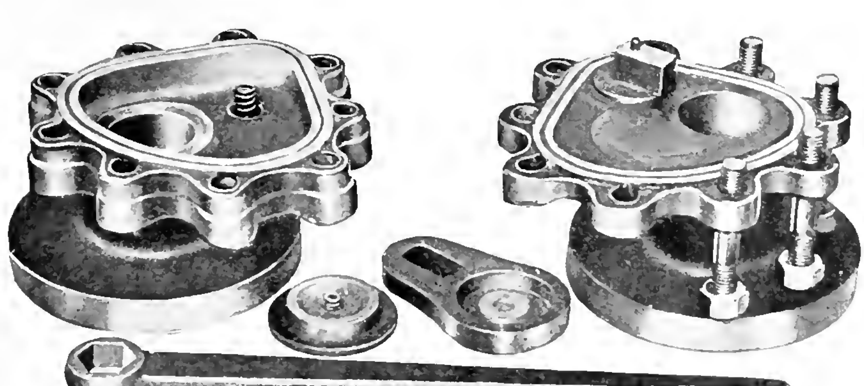


Fig. 4

High-Pressure Blow-off Valve.

White Star Works Apprenticeship Scheme. Annual Prize Distribution.—The interesting event in connection with the Annual Prize Distribution to the White Star Works apprentices took place on the 15th February. Mr. E. L. Fletcher, one of the assistant managers, was present. Mr. Willett Bruce, in opening his remarks, said that since the inauguration of the scheme in 1905 they had made satisfactory progress, but still he would like to see better results. Taking the technical results obtained during the 1908-9 session, out of a total number of thirty-eight apprentices in the scheme, nineteen were examined, with the result that twenty-five certificates were gained, and out of that nineteen, five failed. He was sorry to say that this was not quite as he would like to have seen it, as he considered a greater number should have taken up the examinations. The scheme was got up for the benefit of the apprentices by the Company, and they wanted to bring them up in such a way as would contribute towards their attaining the highest standard of efficiency. This year the position had been rather a peculiar one. According to the original scheme, the apprentices must have been in the Works two years before they were eligible to compete, and owing to the non-success of the senior apprentices to obtain the maximum number of marks it resulted in there being no winners of the Company's prizes. But a number of apprentices under the two-year standard led the way and obtained the highest marks, and according to the existing rules, were debarred. In the face of these existing conditions a revision of the scheme was necessary, to remove certain restrictions and permit those apprentices, with over one year's service, and who attended the classes prior to the termination of their second year, being eligible to compete, and upon him, Mr. Willett Bruce, placing the subject before the committee of management the whole question was reconsidered, resulting in the alterations as suggested, being approved. Owing to Mr. Ismay's deep interest and sincere desire to give encouragement, he permitted the alterations to be retrospective, with the result that two of the junior apprentices, namely Vivian S. Lord (engineer apprentice) and H. Davis (apprentice sheet metal worker), became entitled to the Company's prizes (applause). He thought that the apprentices would agree with him that this was a most satisfactory and gratifying arrangement under the existing conditions, and felt that they would individually and collectively show their appreciation in the future. Mr. Willett Bruce pointed out that this decision had occasioned a revision of the existing rules, which would shortly be put before them, particularly regarding the distribution of marks. Several little weaknesses in the scheme had been brought to light, one of which was that some apprentices who passed in the Elementary Stage, instead of continuing in the Advanced Stage of the same subjects, had gone on to some other subject in the Elementary Stage. Instead of jumping from one subject to another in the Elementary Stage, it would be much better to get a thorough knowledge of fewer subjects. Dealing with very young and junior apprentices who range from a year to a year and a half, Mr. Willett Bruce thought they deserved special commendation, and mentioned the names of J. F. Field, who had passed first class in three elementary subjects; J. Owens, who had passed first class in three elementary subjects; and M. Lynch, who had passed second class in two elementary subjects. There was one thing which appealed to him very much, and he had talked the matter over with Mr. Ormston and Mr. Allen, and felt that with so many labour-saving appliances being brought into use, that apprentices in handling these tools did not gain the experience with the hammer and chisel which all marine engineers should be thorough masters of. A scheme would be formulated to give a prize for workmanship to be restricted to apprentice engineers only, this being the most important branch, and there being a greater number who eventually go afloat. The idea is to give out a certain amount or class of work to be executed in a given time, and in the most satisfactory manner. Mr. E. L. Fletcher was called upon to present the prizes and said in a few well-chosen words how much pleasure it gave him to do this. He spoke of the great importance the management attached to the works, and of how much more satisfactory it was to have their own system of apprenticeship under superintendents who had the apprentice's interests at heart. The prizes having been distributed the proceedings closed with a vote of thanks to Mr. Fletcher.

White Star Works Staff Dinner.—The staff of the White Star Works held their Seventh Annual Dinner on February 5th, at the Carlton Restaurant, Eberle Street. The company, numbering over eighty, comprised a large number of the Staff, their friends and representatives of other departments of the Line; and was presided over by W. J. Willett Bruce, Esq., R.N.R., superintendent-engineer of the Company. After an excellent dinner, served in the usual high-class "Carlton" style, the following toasts were proposed, interspersed with a programme of vocal and instrumental items rendered by members of the Staff and their friends, all of which were very highly appreciated. Mr. W. J. Willett Bruce in loyal terms gave "The King," which was duly honoured, Mr. J. T. Bryson rendering the solo. "The Firm" was proposed by Mr. H. I. Thorpe, victualling superintendent, who, in a most eloquent speech, reminded the company that the management of the White Star Line had always stood for integrity and discipline, and it was due to these two great principles that the Line had attained its high efficiency. Such gatherings as these united the various departments together for the common good of the whole. Mr. C. H. Ireland, a member of the head office staff, in replying, expressed the firm's gratitude for the enthusiastic way in which the toast had been received, and assured those present of their high appreciation of the continued fervent zeal on the part of the staff in the interests of the Line. Mr. C. A. Allen proposed "Our Visitors" and musical friends, and in welcoming them there that evening, mentioned the names of Mr. Maginnis, Mr. R. Nairn, Mr. W. Taylor, Mr. McKenzie, Captain Graham, Mr. Carnaghan, Mr. Thos. Anderson, Mr. C. Hurst and Mr. John McKee, all of whom were present. Mr. W. Taylor responded on the part of the visitors, expressing the great pleasure it gave them to join the staff on this occasion, and Mr. R. Nairn replied for the musical friends. Mr. Maginnis, who was a former member of the works staff, some twenty-nine years ago, also expressed his pleasure in again being among some of his former colleagues, and made some very feeling references to old associations. "Our Chairman" was proposed by Mr. P. M. Wells, who pointed out Mr. Willett Bruce's ever readiness to promote any movement for the welfare of his staff, both in business and socially, the toast being most enthusiastically received and musically honoured. Mr. Willett Bruce, in replying, paid a very high tribute to the staff, both ashore and afloat, thanking them for their loyalty to himself and the other superintendents, which enabled them to maintain that high efficiency throughout the fleet which the firm held them responsible for.

CORRESPONDENCE.

We do not hold ourselves responsible for the opinions expressed by our correspondents.

To the Editor of the Marine Engineer and Naval Architect.

Sir,—I have read the interesting and instructive article in the current issue of your well-known paper on "The Function of the Air and Circulating Pumps," and in one of the concluding paragraphs I observe it is stated that "india-rubber is rapidly giving place to metal valves." Would you permit me to mention, apropos of this subject, that Dermatine Valves (reinforced with the Patent Anchor Bush) whether flexible for working against a curved guard or hard for a flat guard, are in many cases preferred to either of the kinds specified. They resist the action of oil and high temperatures better than india-rubber. At the same time, by giving a more effective seating than metal valves, and consequently a higher vacuum, they increase the total efficiency of the pump. In addition they work more smoothly and without noise. For these reasons, therefore, many high-class Pump Makers and Engineers now adopt Dermatine in place of metal, india-rubber or other composition.

I am, Sir, Your obedient Servant, C. R. C. HARP,
General Manager of the Dermatine Co., Ltd.

REVIEWS.

Wireless Telephones. By James Erskine-Murray, D.Sc. London: Crosby, Lockwood & Son. Price 1/6 net.

The advance in the use of wireless telephones has rendered the treatment of a subject complex in character, but extremely interesting, in a simple form readily understood by the public, to be almost a national necessity, and the author in nine short chapters has treated the subject with commendable ability. So much do the telegraph and the telephone enter into our business, social and domestic life as a nation, that it is only reasonable to assume, that the intelligent portion of our population would welcome a simple and concise treatise, explaining what to them must be almost in the nature of a mystery. A further point of importance is that when principles of operation are understood, inventive and inductive thought is encouraged among those who have a desire to further extend the forces of nature for the benefit of mankind. Having regard to the important place wireless telephony occupies in our Navy and mercantile marine we feel sure that this book will fill a distinct want which must have been felt for some time past.

Thornton on Patents. By Alfred Augustus Thornton. London: Charles Jones, Limited. Price 21/- net.

This is a text book which has been compiled by an author, who is himself a patent agent, which could become a *vade mecum* to the patentee, the lawyer, the co-owner of patents, the master and servant, the infringer and the infringed, as some guide to them on the various points that must constantly arise in connection with such matters. Although this appears to be rather an extensive scope of subject, the author has been careful to point out the difficulties which arise in dealing with various branches of the subject and on which the necessity of expert advice is obvious. The treatment of the matter is totally different from that which one is accustomed to in those text books which have been written by lawyers for lawyers, and therefore there is really no basis of comparison between the two as each class of book has a special object of its own. There is nothing new in the presentation of what constitutes invention, procedure of application, drafting and construction of claims, revocation, restoration and prolongation, but the relations of patentee and financier in matters relating to the negotiating of patents, are not only interesting in themselves but instructive to the public. A considerable portion of the book is occupied in the reproduction of the various official forms, each filled in in accordance with the practice of the Patent Office, the utility of which does not appear to be great, as the officials are only too anxious to assist the public in the preparation of the matter that is to be formally inserted, and forty pages utilized in this way does not appear to warrant the space taken up judging by the small utility achieved. Then again, a word of warning should be given as to the judicial dicta which, while useful to those who understand the principles on which the judgments are based, become very misleading to those who are ignorant of them, and it is in such matters as these that the wise level-headed layman will not rely upon such dicta but will go to those professional individuals who have made a life study of the subject. The section with regard to foreign patents really only touches the fringe of the subject, and any individual with no previous experience of attempting to file applications in foreign countries on procedure of such scant a character as can be obtained from the information given, is only likely to waste his money and probably lose his inventions. On the whole we may congratulate the author upon his novel treatment and express a hope that he will be rewarded for the considerable amount of work which he must have done in the production of this book.

Seaton & Rounthwaite's Pocket Book of Marine Engineering Rules and Tables. 10th edition. Revised and enlarged. London: Charles Griffin & Co., Ltd. Price 8/6.

This extremely useful pocket book of memoranda, tables, etc., relating to marine engineering appears again in a new edition which has been considerably enlarged and revised, so as to bring the matter up-to-date in every respect. The previous edition was issued in 1905, and it follows that the fresh experience gained by the modern discoveries made since that date has required not only modifications, but also additions to rules, while the increased sizes of ships and machinery connected therewith, together with higher boiler pressures and lower condenser pressures, has necessitated the extension of the tables to include these developments. The Standardization Committee's reports have had great influence on the Board of Trade, Lloyd's Register of Shipping, the British Corporation and the Bureau Veritas, with regard to the rules and regulations issued by these bodies and in accordance therewith the rules have been modified in this pocket book. Further addition has been necessary owing to the new regulations issued by the Board of Trade with reference to motor boats and also with regard to the testing of steel castings and forgings for ship and engine purposes. The index has been materially improved, enabling easy reference to be obtained on any matter dealt with, while the substantial binding and paper employed render the pocket book a thoroughly durable one under ordinary conditions of use.

Steam and Steam Engines. By Prof. H. Jameson. 16th edition. London: Charles Griffin & Co., Ltd. Price 10/6.

It is obvious that this well-known text book is very well read and supported, the edition before us being the sixteenth. The work may be regarded as an easy introduction to Professor Rankine's equally well-known treatise on the steam engine and to Mr. Seaton's practical and highly appreciated manual of marine engineering. The illustrations are both excellent and diffuse, and give the reader a practical view of the subjects dealt with. With regard to the general text of the book, the physical portion including the action of heat is most clearly expressed, and the science of the steam engine is well worked out and made very readable for the average student. Engines in every variety are illustrated. In the chapter on turbines the theory of the De Laval system is excellently described, and discussed, whilst the Parsons and Curtis systems are well considered and set out. The appendix E and special lectures XIII., XVI. and XX. have been extended to include a special plate and description of the new "Cipollina" duplex indicator, whereby simultaneous diagrams are obtained from each end of the cylinder; the most economical engine on record, and a table of some of the best and most reliable results of non-condensing compound triple-expansion engines. No effort has been spared by the author and publisher to make the volume a continued success.

The Steam Engine. By Professor Rankine. 17th edition. London: Charles Griffin & Co., Ltd. Price 12/6.

The popularity of this work is attested by the number of editions it has passed through. The edition before us—the 17th—opens with descriptions and illustrations of Newcomen & Watt's steam engines, followed by the Comet and the Rocket. After this historical sketch, an introduction is given to show the nature of resistance and work, and a full description of acceleration, gravity, mass and momentum is well set out. Reciprocating force and periodical motion are next gone into, with traction dynamometers, and then we have engine indicator diagrams and boilers. Here the crushing of flues and the tenacity of the boilers and pipes are given, and the introduction winds up with the strength of beams and of axles. In Part II. water and wind power are dealt with, from a general point of view, illustrations and descriptions of water wheels, turbines and wind-mills being given. Part III. is very lengthy, the subject is steam and other heat engines, and commences with various relations amongst the phenomena of heat, and treats afterwards with combustion and fuel. The principles of thermo-dynamics is well considered, and forms an important subject of the book, including, as it does, theoretical diagrams of energy from steam, the action and advantages of super-heated steam, winding up with examples of steam and other engines with results. Furnaces and boilers are included in this part, and a long series of the mechanism of steam engines is given, with full illustrations of parts, including pumping and marine engines and locomotives. Part IV. contains full details of electro-magnetic engines with appendices and addenda, including new illustrations. Part V. brings to a conclusion this excellent work and contains a chapter written by Bryan Donkin upon gas, oil and air engines, in which both illustrations of the different engines described, are given, with closely detailed descriptions of the various types there defined. The whole volume is one that all students in the engineering world should study and know.

CATALOGUES.

Messrs. Balcke & Co., Ltd., have sent us their latest illustrated catalogue, containing a description of their centrifugal pumps. The pumps are made in any size, from the very smallest to the very largest, both horizontal and vertical, for low lifts and for the very highest lifts.

The Electric and Ordnance Accessories Co., Ltd.—This Company has just issued its catalogue dealing with the Victor Arc Lamps, including standard enclosed, miniature enclosed and flame types. Among many illustrations a ship's deck lamp is shown for brilliantly illuminating a prescribed area of the deck of a vessel when loading or unloading at night. This lamp is provided with a deep metal reflector with stay eyes fixed to its lower edge, and a galvanized wire net to prevent broken globes from falling on to the deck.

BOOKS RECEIVED.

The Gas Turbine. By H. H. Suplee, B.Sc. Price 12/6 nett. London: Charles Griffin & Co., Ltd.

Rhodes's Directory of Passenger Steamers, 1910.—Price 2/6 nett. London: George Philip & Son, Ltd.

Year Book of Scientific and Learned Societies, etc.—London: Charles Griffin & Co., Ltd.

The Design of Condensing Plant.—By F. W. Wright. Price 3/6 nett. London: Technical Publishing Co., Ltd.

Internal Lubrication of Steam Engines.—By T. C. Thomsen. Price 2/6 nett. London: Technical Publishing Co., Ltd.

Les Flottes de Combat en 1910.—By Commandant de Balincourt. Price frs. 5. Paris: Berger-Levrault et Cie.

The Engineers' Year Book, 1910.—By H. R. Kempe, M.I.C.E. Price 8/-. London: Crosby, Lockwood & Son.

OBITUARY.

John C. Dobbie.—We regret to have to put on record the death of Mr. John Clark Dobbie, director of the well-known firm of Messrs. Dobbie-McInnes, Ltd., nautical instrument makers, whose head office is in Bothwell Street, Glasgow. The sad event occurred from heart failure supervening on pneumonia at the deceased's residence, 97, Iverna Court, Kensington, London, on Feb. 8th. Deceased who was forty-eight years of age, was the youngest son of the late Mr. Alexander Dobbie, Clyde Place, Glasgow, who was a nautical instrument maker of note. In early life deceased joined his father's business, and under his more immediate direction it greatly developed. About a dozen years ago there was amalgamated with it the business of Messrs. T. S. McInnes & Co., makers of indicators and other engineering instruments, the joint firm becoming known as Dobbie, McInnes, Ltd., whose productions both in the way of compasses, sounding machines and other nautical instruments, and of instruments for the engine and boiler rooms of steamers, have long been well known. More recently Mr. Dobbie amalgamated with his firm the business of Messrs. Gebbie & Co., Greenock, and Messrs. D. McGregor and Co., Glasgow and Liverpool, both of which were also old established. Mr. Dobbie, about three or four years ago, took up his residence in London and looked after the interests of the firm's business in the Metropolis, the show rooms and office being at 113, Fenchurch Street. Under the amalgamated arrangement Mr. Dobbie, as managing director, has had associated with him, as director of the nautical department, Mr. W. W. Gebbie, and as director of the engineering department, Mr. Walter P. Clyde, formerly of Messrs. T. S. McInnes and Co., in both of whose experienced hands the large business is not likely to suffer. Mr. Dobbie and his co-directors at various times patented and introduced improvements in connection with compasses, sounding machines and steam and gas engine indicators, and Mr. Dobbie, who was an Associate of the Institution of Naval Architects, read an interesting paper before that body two years ago on "The modern developments of the mariner's compass," in which attention was drawn to features which distinguish the "Dobbie" reduced diameter card, liquid compass now meeting with great approval from navigators.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

Australia's Navy.—The event of most outstanding interest in the industrial activity of Clydeside during February was the launch on Feb. 9th of the torpedo-boat destroyer *Parramatta* from the stocks of the Fairfield Shipbuilding Co., Govan. As a warship the *Parramatta* would in the Home Fleet rank only as one among many similar small vessels, but as the first ship of war ever built for British oversea dominions she marks a very important turning point in the history of the Empire. She forms the first unit of a fleet for Australia, and represents the beginning of a policy of colonial naval defence, conceived in a spirit of self-help, combined with perfect loyalty to the British Crown. The occasion was marked in a special manner, a representative company of naval and other authorities being present, and the ceremony of launching being performed by Mrs. Asquith, wife of the Prime Minister. The *Parramatta* is one of three similar craft at present being built on the Clyde for the Australian Commonwealth, the contracts having been placed in April last, two with the Fairfield Company and one with Messrs. W. Denny & Bros., Dumbarton. The Fairfield Co.'s second vessel, which will be named the *Warrego*, will be shipped in pieces to Australia for re-erection and completion there at the hands of Australian workmen, who are now gaining experience on the Clyde. Messrs. Denny Bros.' vessel, which will be named *Yarra*—all three names being those of Australian rivers—will, like the *Parramatta*, be completed before leaving the Clyde. The vessels are being constructed under the superintendence of Prof. J. H. Biles, of Glasgow University, and are essentially of the British "River" class of destroyers, with improvements. Their dimensions are:—Length, $245\frac{1}{2}$ ft.; breadth, 24 ft. 3 in.; and 700 tons displacement, compared with 222 ft. length, 23 ft. 6 in. breadth, and 600 tons displacement in the "River" class. They are to have turbine machinery, steam being raised by oil fuel, and are to have a speed of 26 knots, while the "River" craft have reciprocating engines, coal-fired water-tube boilers, and attain, with a full sea-going load, $25\frac{1}{2}$ knots speed. The radius of action of the Commonwealth destroyers will be greater than the "River" class, enough oil being carried to enable them to steam 2500 knots.

Messrs **David & William Henderson, Ltd.,** of Meadowside Shipyard, Partick, have been commissioned by the Anchor Line to build and engine a large passenger and cargo steamer for their Glasgow and New York service similar in type to the *Caledonia* and other steamers which are at present engaged in the trade. The new steamer will be 515 ft. long, 62 ft. broad and $36\frac{1}{2}$ ft. deep, and will have quadruple-expansion engines capable of maintaining a speed at sea when fully loaded of 17 knots. Besides a capacity for 6500 tons of cargo the vessel will have superior accommodation for 250 first-class, 500 second-class and 1000 steerage passengers.

Messrs. **William Simons & Co., Ltd**, Renfrew, the well-known designers and constructors of dredgers and dredging plant, have received an important order from the Admiralty for one of their recent specialities—the "Simons" suction cutter-hopper dredger. Some time ago the firm built the suction cutter-hopper dredgers *Jinga* and *Kalu* for the extensive Sewri reclamation scheme at Bombay. So satisfactorily have these vessels performed the work they were designed to do that the Lords of the Admiralty have now ordered from Messrs. Simons a hopper dredger of the same type. The new vessel will be of larger dimensions, and it is understood that she will, when completed, be employed in deepening work about the neighbourhood of various of the Royal dockyards. She will have a hopper capacity of 2000 tons, and be able, by means of the rotary cutter in front of the suction pipe, to work effectively in depths of 60 ft. of water.

Messrs **Yarrow & Co.,** of Scotstoun, early in February were reported to have been commissioned by the Danish Government to build a torpedo boat of 240 ft. length and high speed. While this is wanting in confirmation it is known that altogether three craft of the kind were in the market. It is not as yet certain whether, or where, the other two vessels have been placed.

Messrs. **The Clyde Shipbuilding and Engineering Co.,** Port

Glasgow, who, as stated in last month's notes, have secured a number of important ship repair contracts—including the overhaul of hull and machinery of the Brazilian cruiser, *Barossa*, and the lengthening of the Elder, Dempster steamers *Zaria* and *Muraji*—have since contracted to build a steamer for service on the Canadian Lakes similar to two others the Company have now on the stocks. They have also recently booked the contract for a high-class steamer of 4800 tons deadweight capacity for the Adria Steamship Co., of Trieste. There is at present undergoing completion in the Co.'s tidal basin the screw steamer *Luxemburg*, recently launched for the Leith, Hull and Hamburg Co.'s fleet.

Messrs. Ferguson Brothers, Port Glasgow, have been commissioned to build and engine three powerful twin-screw tug steamers for the Port of London Authority.

The Greenock and Grangemouth Dockyard Co. have been commissioned by Messrs. Paton & Hendry, Glasgow, to build a steamer for cargo coasting trade of 1050 tons and of high average speed, similar to one which the same firm have recently placed with Messrs. Mackie & Thompson, of Govan. Engines for the Greenock-built vessel will be supplied by Messrs. David Rowan & Son, Glasgow.

Messrs. Scott's Shipbuilding and Engineering Co., Greenock, have received an order from the Booth Steamship Co., Liverpool, for a twin-screw passenger steamer which will be propelled by quadruple-expansion engines. The dimensions of the vessel will be :—Length, 440 ft. ; breadth, 54 ft. ; depth, 38 ft., tonnage, 7000 gross. She will have a speed of 16 knots and accommodation will be provided for 200 first-class and 400 second-class passengers.

Messrs. Murdoch & Murray, Port Glasgow, who launched a steamer for Messrs. John Bacon, Ltd., Liverpool, on February 13th, have now on the stocks or on order five steamers, three of which recently contracted for are passenger steamers on which all classes of shipyard workers will be employed. Two of these are for service in South America, and the other in China. All will be fitted with machinery by outside firms, Messrs. Murdoch & Murray not being themselves marine engineers.

The Campbeltown Shipbuilding Co. were commissioned about the end of January to build for German owners a cargo steamer of about 2000 tons, the engines for which will be supplied by a Glasgow firm. Delivery is required early in the summer.

The Dundee Shipbuilding Co. have received orders to build two barges of special dimensions for South American owners and a twin-screw steamer of light draught for a foreign firm. They have also booked an order for a large passenger steamer for colonial owners, which will be engaged plying between Canadian ports.

Messrs. Hawthorns & Co., Ltd., Leith, have recently launched the third of a number of steel screw " whalers " which they are building to the order of Messrs. C. Salvesen & Co., Leith, for their whaling station in the South Atlantic. The vessels are 100 ft. long by 19 ft. beam and 12 ft. deep, and are being fitted by the builders with triple-expansion engines of 400 i.h.p., and with all the latest improvements for whaling purposes.

Messrs. Ramage & Ferguson, Ltd., Leith, have received an order to build and engine a steel screw steamer for Irish owners.

Clyde Dock Extensions.—The special committee appointed by the Clyde Navigation Trust some time ago for the purpose of considering and reporting on a huge scheme of harbour and dock extension on the Trust's lands on the south side of the river, extending from Shieldhall to Renfrew, are about to present the result of their labours to the Trust. It is understood that a large graving dock will be the first part of the scheme to be gone on with, which will be capable of accommodating the largest battleships and ocean liners yet built or likely to be brought into existence for years. The interior length of the dock will be 1020 ft. and it will have an entrance of 100 ft. in clear width, with a depth over the sill of 30 ft. at high water of spring tides. It will lie parallel with the river and will be entered through a large canting basin bounded by extensive wharves, one of which will be 1150 ft. in length. The dimensions and other particulars of the dock have been submitted to the Admiralty, and they have stated that the dock as projected will be ample to meet battleships' requirements for many years to come. At present there is no dock on the Clyde capable of taking in either a battleship or a liner of the maximum dimensions. There is, indeed, no such dock on the West Coast north of Liverpool, and the nearest to Glasgow is that under construction at Belfast, which will probably be opened this year. At the earliest, the projected Clyde Dock cannot be completed before four or five years from now, but once started, work will proceed with exceptional expedition.

Coaling Facilities at Leith.—The superintendent of the docks at Leith has reported to the Dock Commissioners in favour of the formation of four new sidings, each capable of holding twenty-five waggons, near the hoists in the Imperial Dock, so as to facilitate the loading of coal. In discussion it was contended that there were larger contracts than ever effected this year in Lothians coal and the total exports at Leith would probably be about two million tons. Accommodation should be provided for waggons containing in the aggregate 2000 tons, which was a reasonable-sized cargo. The matter was submitted to the Works Committee for further consideration.

Dundee and a Floating Dock.—Dundee Harbour Trust have been approached by a deputation from Dundee Trades Council on the question of providing a floating dock. It was contended that in the interest of ship repairing it was necessary to obtain a floating dock of from 200 ft. to 300 ft. in length, with a lifting capacity of from 1000 to 1200 tons. The patent slip, it was contended, was not convenient for trawlers, and owing to the insufficient width of the East Graving Dock several contracts for the repair and overhaul of large steamers had been lost to the port. The question was remitted to a committee. It was remarked by the finance convener that although the port had a first-class dry dock it was not used nearly so much as it should be. Last year it was idle on 170 days.

TYNESIDE AND WEARSIDE.

(*From our Own Correspondent.*)

Tyneside.

Tynemouth Port Facilities.—Reference has been made in many journals to the completion of the reconstruction of the North Pier, Tynemouth, to the instructions of the river Tyne Commissioners advised by Sir John Barry and Messrs. Coode, Sons & Matthews. The pier is now 2900 ft. long and the entrance to the harbour has been contracted some 120 ft. owing to the change in line of the reconstructed portion, the harbour entrance being now 1180 ft. wide. A new pier head has been built and the pier, founded on the shale, is constructed of concrete blocks with granite facing. Under the promenade a tunnel has been constructed for access to the lighthouse and the fog signalling apparatus in stormy weather. Two new cranes are to be installed at the Fish Quay, North Shields, to assist the unloading of the trawler fleet, and the Newcastle Corporation has under consideration the placing of an additional crane on the Quay at a cost of about £1300. This will be used in connection with general trading vessels, principally in the Baltic trade.

Steamship Owners' Association.—At the 30th annual meeting of the North of England Steamship Owners' Association held in Newcastle, reference was made to the position adopted by the Association in connection with the levy to be placed by the North-Eastern Railway Co. on vessels using the Dunstan staithes. Owing to the action of the Association the provision in the Bill of 1909 included the placing of a levy of only ½d. per registered ton as against the penny levy originally intended. In the very fine address given by the Duke of Northumberland, his Grace emphasized the importance of the administrative side of government, a work which really did more to secure the welfare of the commercial system than much of the legislation which was proposed in Parliament. One of the functions of the Association was to watch the administrative action of the Government and to modify it wherever this can usefully be done.

Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd. The development of this firm's work below the bridges has for some time been a matter of public interest. Land has been secured adjacent to the river at Walker, and extensive arrangements made to facilitate the building of warships of the largest class, including the construction of two berths. News has now been made public that it is intended to transfer the shipbuilding department of the firm from Elswick to Walker, both on account of the difficulty of navigating large

vessels down the river past the bridges, and also because the engineering department at Elswick urgently requires more room for expansion.

Messrs. R. & W. Hawthorn, Leslie & Co., Ltd.—The work of this firm is being maintained in a good state of activity, one of the recent vessels which underwent her sea trials being the *Protesilaus*, built to the order of Messrs. Alfred Holt & Co., for the Far Eastern trade. This boat was engined by the North-Eastern Marine Engineering Co., Ltd., of Wallsend. Messrs. Hawthorn, Leslie & Co., are adding to their works equipment.

Brazilian Battleship.—The large Brazilian battleship built by Sir W. G. Armstrong, Whitworth & Co., Ltd., and which has been called the *Minas Geraes*, and which has been lying at Jarrow Slake, has now left the Tyne on her way to Rio de Janeiro, and will form a most powerful addition to the strength of the Brazilian Navy.

Wearside.

Port of Sunderland.—The figures concerning the returns for the port of Sunderland for the year ending December 31st, 1909, have now been submitted to the River Wear Commission, and the trade of the year shows an increase of fifty-nine vessels with an increased registered tonnage of 110,094. From the local press reports Colonel T. C. McKenzie is said to have drawn attention to the quantity of coal shipments, the river shipments now exceeding the dock shipments, which is the reverse of the state of affairs a few years ago. This is attributed to the fact that owing to dredging operations the facilities for river shipments have been greatly increased and vessels which were formerly loaded in the dock could now be dealt with in the river. A bill is being promoted in Parliament in order to adjust the charges so as to distribute them more evenly between the river and the docks. Sunderland has now been made essentially a deep-water harbour for the first time by the extensive dredging operations which have taken place, more particularly as regards deepening the channel. It is apparent that the river Wear Commissioners are adopting a very wise course in this respect having regard to the increasing competition which is being felt from neighbouring ports and the development of new coal centres.

Messrs Sir J. Laing & Sons, Ltd—Welcome news has now come to hand that Messrs. Sir James Laing & Sons, Ltd., of Deptford Yard, Sunderland, the stoppage of whose shipbuilding yards contributed largely to the industrial distress of the area, are now about to recommence work. The sum of £50,000 in 6 per cent. second debentures has been found to enable them to do this, and work on a large steamer is to be started at the earliest possible date. The works are largely operated by means of electricity from the Corporation generating station, and the Electricity Committee has given instructions that any work which is necessary to re-establish a supply to the yard shall be urged forward as much as possible in order to place no delay in the restarting of the works.

Messrs. S. P. Austin & Son, Ltd.—Messrs. S. P. Austin and Son, Ltd., of Wear Dockyard, Sunderland, are at present doing a very considerable amount of work, in spite of the general trading depression. They have at present in their docks two steamers undergoing the repairs necessary for Lloyd's special survey, and other work is expected shortly. They have two steamers at present in course of construction at their shipbuilding yard and are preparing the frames of a third vessel. An interesting commentary on the coal trade troubles which now, happily, seem to be coming to an end, is that this firm has a new steamship alongside, fully completed, but which cannot be employed in her regular trade until the settlement of the coal question in the Wearside area.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, are reported to have secured an order to build a large steamer for the Booth Line, of which four orders are reported to have been placed on the North-east Coast. They are intended for service between Liverpool and the River Amazon, and will carry upwards of 200 passengers as well as cargo. The workmen employed at this yard have come out on strike against the continuance of three-quarter time, instead of full time being conceded. Joint conferences are being held, but up to the time of going to press nothing has been settled.

Messrs. W. Harkess & Son are reported to have secured an order to build a small cargo steamer and are now fairly busy. It is reported that the co-partnery yard to be started between South Bank and Grangetown will be for the manufacture of steel bars and billets by a Sheffield firm.

Messrs. Smith's Dry Dock Co. are very busy, they have upwards of twenty trawler tugs, etc., to build, varying in size up to about 120 ft. long. It is reported that since the opening they have had 160 boats repairing, etc., through their hands. Recently they have added to their official staff two gentlemen well known on the Tyneside.

Messrs. Richardsons, Westgarth & Co. are fairly busy; they are reported to have secured an order for machinery for a locally built boat, but nothing definite is known.

Stockton and Thornaby.

Messrs. Robert Ropner & Son are reported to have secured an order to build a large cargo steamer and with the new work on hand are fairly busy.

Messrs. Craig, Taylor & Co. are busy with the large cargo steamer for the Albyn Line, Sunderland, and she is reported to be required for delivery in July certain.

Messrs. Richardson, Duck & Co. are fairly busy now, but nothing special is reported during the past month.

Messrs. Blair & Co. are very busy considering the dulness of trade, they are supplying the machinery of 1000 i.h.p. for the Albyn Line steamer building by Messrs. Craig, Taylor and Co.

West Hartlepool.

Messrs. W. Gray & Co. are now very busy at both the old and new yards, overtime having been worked in the drawing office all this year. They are reported to have secured two large cargo vessels to build, which with those on hand, will keep them well employed all through the year. Their dry docks are also constantly engaged, several smart pieces of work having been done by this firm.

The Central Marine Engine Works are very busy on work for the boats built by Messrs. W. Gray & Co., several orders having been booked quite recently and all for early delivery.

Messrs. Irvine's Dry Dock and Shipbuilding Co., Harbour Dockyard, are very busy; they have just launched a boat for Messrs. Milburn & Lund, Whitby and West Hartlepool, and have already got the keel down and are commencing to erect the frame. They are also busy in the dry dock department. Messrs. Crosby, Magee & Co. have placed an order for a large cargo steamer with the Northumberland Shipbuilding Co., Howden-on-Tyne, the builders of their s.s. *Teesbridge*, built last year for the same owners. The machinery will be supplied by the Sunderland works of Messrs. Richardsons, Westgarth & Co. She has been contracted for at a very low figure and will be delivered about the back end of the year.

Hartlepool.

Messrs. Richardsons, Westgarth & Co. are fairly busy, the steamer they are to engine and boiler for the Albyn Line, Sunderland, is a sister ship to the one building by Messrs. Craig, Taylor, Stockton, of 1600 h.p. for early delivery. It is rumoured they have secured the contract to supply the machinery for one of the Booth Liners of about 2500 i.h.p., to be built locally. They have also booked an order to supply a 3000 K.W. turbo alternator generator, with condensing plant, for the Brighton Corporation, and are kept busy in this department.

Messrs Irvine's Shipbuilding and Dry Dock Co., Middleton, are now very busy on account of pressure for delivery; they have had to stop work on the two co-partnery steamers placed by Sir C. Furness to enable them to give early delivery for the other steamers. Although there is good enquiry for the better class of cargo steamer, not so much tonnage is placed and the tendency is to stiffen in price and delivery.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

The Marine Engineers' Association, Hull.—The new rooms of the Association at 6, Dock Street, were opened on the 15th February. Mr. C. Malam the President of the Humber Ports, including Hull, Goole and Grimsby, occupied the chair.

He was supported by Mr. Marshall, the General Secretary, from London, and by Councillor D. Livingstone, Honorary Member. The meeting was well attended by engineers of the port. The minutes having been read and confirmed, the business began of electing the President and Vice-President and Auditors for the ensuing year of office; the retiring officers (presenting themselves for re-election) were elected unanimously. A pleasing duty during the evening was the unveiling of a portrait of the Ex-President, Mr. A. N. Sommerscales, who had occupied the chair for four years—the President performing the ceremony in a few well-chosen words. It was regretted that Mr. Sommerscales was prevented from attending owing to indisposition. Mr. W. Marshall gave an eloquent address on the working of the Association and its branches, work which the members greatly appreciated. He also impressed upon the members the necessity to band themselves together for the common good, and to endeavour to induce others to join and so increase the membership. He mentioned that it was pleasing to know that all the branches were sound in finance. Councillor Livingstone gave some excellent advice which he trusted would take root among them. He promised to take the members round the Tram and Electric Power Station, when a convenient date could be fixed, and he would interview the Chairman to arrange the visit. The Corporation Staff would meet them and explain things fully to the members. He assured the members that the visits would be an education to each one of them something for sea-going engineers to learn of the workings ashore. The usual vote of thanks was passed to the Chairman, Mr. Marshall, and to Councillor Livingstone. Members visiting Hull will find the rooms very central, all City cars stop close by, there is plenty of reading matter, and a good billiard table in the Association's rooms.

Messrs. Earle's Shipbuilding & Engineering Co., Ltd., are keeping rather busy with repair work. They have also booked two orders, cargo boats for the London, Brighton and South Coast Railway Co. The alterations to the s.s. *Bruno* have incurred heavy cost. She has now been sold to an American steamship company to ply on the lakes. The s.s. *Seagull*, of the Netherland Steamship Co., has had her annual overhaul, and is now in commission again.

Humber Iron Works have been keeping fairly busy, in docking and slipping a number of steamers, and have had also several enquiries for new boilers. Their patent slip is well booked up in advance for steamers coming to the Humber.

Messrs. Cooper & Co., Ltd., Engineers and Boilermakers, are fairly busy at their Neptune Engine Works and in their moulding shop, especially in propeller work for foreign account. The branch shop at the Alexandra Dock has been busy dry docking several steamers and doing general repairs. Their own two dry docks are very busy, and booked up to the end of the month with orders.

North-East Coast Engineering Works.—This new firm is pushing ahead with repair work, they have also had the steamers *Medomsley* and *Cragoswald* undergoing deck and engine-room repairs, and three local tug-boats.

Messrs. Amos & Smith, Engineers and Boilermakers, have been very busy with repair work, and had to engage Hull and Barnsley Dry Docks and North-Eastern Railway Co.'s Dry Docks. They have been docking several Wilson line and Liverpool steamers for usual outside work, deck and engine repair work. No fresh orders for engines or boilers.

Messrs. Cochrane & Son, Shipbuilders, Selby.—This firm is like many others on the East coast, awaiting fresh orders. I have heard that they have booked several herring-drifters for delivery for this season's herring-fishing. The local trawler owners are not placing any orders.

W. H. Warren, Shipbuilder, New Holland, is keeping fairly busy, and has building at present the following:—Coasting steamer, 105 tons, for local owners. A motor barge, 60 tons. Lighter on order, 200 tons, and one built for sale, 190 tons. Plenty of enquiries, not many orders. A fair amount of repair work on hand, and slipping London barges.

Messrs. Cook, Welton & Gemmel, Shipbuilders, Beverley.—This firm is slack; the trawler owners are not placing any orders just now. The firm is finishing three trawlers for Grimsby owners.

Messrs. C. D. Holmes & Co., Ltd., Engineers and Boilermakers.—This old-established firm of repute is doing very little, considering the amount of work done by them in former years. I understand they have in their fitting and boiler-shops only engines and boilers for three trawlers. Their branch works at Alexandra Dock have had several ships repairing and dry-docking, with the usual engine and deck repairs.

Messrs. Woodhall & Co., Engineers, have had a fair month with repairs on several coasting steamers. Their chain testing machine has been busy, testing for several Companies and Corporations.

Central Dry Dock & Engineering Co., Ltd., always seem to keep to the front as regards docking of ships and repair work. They have docked ten steamers in their own dock. The s.s. *Stait* and s.s. *Karn* both have had extensive damage done, costing a considerable amount of money. Both are now again in commission. The Company also had to secure railway docks for dry docking.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

Messrs. Simpson, Strickland & Co., Ltd., Dartmouth.—This firm have just delivered several launches, one being a very fine 32-ft. double-skin mahogany steam launch fitted with triple-expansion engines and an oil-fired boiler which has been supplied for Mr. H. Loeffler's s.y. *Albion*. Another very interesting launch has been sent across to France for Monsieur Le Duc De Valencay. This was a 30-ft. launch fitted with four-crank triple engines and a coal-fired water-tube boiler. Very exceptional conditions were laid down by the owner, who called for a continuous speed of 14 knots fully loaded, a good sea boat absolutely free from vibration and noise at all speeds and the total weight of the launch for lifting into davits had not to exceed $2\frac{1}{2}$ tons. All these conditions were fully complied with, and the boat ran her official trials in the presence of the owner at Havre in a very heavy sea. A $36\frac{1}{2}$-ft. steel motor pinnace for the Russian Government has also just completed her trials and was despatched to the Imperial Russian cruiser *Rurik*. She is fitted with one of Messrs. Lindsay Carverhill's 32 B.H.P. paraffin motors and completed her trials in the presence of the Russian officers. Work in hand last month included a 20-ft. motor launch for Mr. A. K. Stothert, owner of the racing yacht *Mariska*; 27-ft. and 28-ft. steam launches for the new steam yacht building on the Clyde to the designs of Messrs. G. L. Watson & Co., for Mr. E. Joel; also a 20-ft. steam launch for a French yacht building at Leith. A 33-ft. steam pinnace is building for the Italian Government and is a duplicate of a boat already supplied; also a 55-ft. steam launch is in hand for the Brazilian Government. Extensive repairs were carried out last month to the Brazilian steamer *Rio Madeira*, bound from Preston to Manaos. This vessel received extensive damage during a heavy sea. 70 ft. of bulwark were taken down and set up fair, and sundry deck losses made good, also the machinery was overhauled.

Messrs. Summers & Payne, Ltd., Belvidere, Northam.—Extensive repairs are in hand to *Zenaida*, R.Y.S. (Sir Frederick Johnstone, Bart.), which was undergoing Lloyd's No. 3 Survey at the yard last month. Lord Lonsdale's *Norseman*, R.Y.S., was also opened up for Lloyd's No. 3 Survey last month. The auxiliary three-masted schooner *Invincible* (The Hon. Herbert Squiers) was docked on the 10th of last month and then sailed for a cruise in the Mediterranean. The s.y. *Lantana* (Mr. Matthew Cope) is being fitted with all new standing rigging and fitting out for the coming season. The *Grainaig*, R.Y.S. (The Duke of Westminster) and *Lady Evelyn*, R.Y.S. (Mr. Paris Singer) are both awaiting orders.

Messrs. Day, Summers & Co., Ltd., Northam Iron Works.—Last month the steam yachts *Medusa*, *Vanduara*, and *Honor* were fitting out at the yard, and the latter has been chartered by an American gentleman. The steam yacht *Highwayman* has been sold and will sail on completion of her outfit. The new steam tug for the Isle of Wight Steam Packet Co. was launched last month, and the keel is now being laid on the berth she has vacated for a new vessel, the order for which was booked recently. The firm are carrying out extensive alterations and additions to the s.y. *Albion*.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works.—H.M.S. *Savage*. This vessel will be launched early this month and all work in connection with hull and machinery is well

advanced. The steering gear was fitted last month and the laying of corticine completed. H.M. destroyers *Larne*, *Lyra*, *Martin* and *Minstrel*.—During the last month good progress was made with the framing and plating of these vessels. *Baron Horace Gunzburg* is the name of the shallow-draught paddle tug recently completed for Russia. She was launched on the 28th January last, and successfully completed her trials on the 14th of last month. She has since been dismantled and will be conveyed in sections to her destination *via* The Trans-Siberian Ry. *Vulcano*.—This vessel, which is for mine-laying and torpedo base vessel for Portugal, made a preliminary run last month, when very satisfactory results were obtained. Messrs. Thornycroft & Co. are now building a motor launch to be carried in this vessel's davits. Good progress has been made with the motor boats on order. Repair Work.—The firm's Repair Department has been well employed on the following vessels: R.F.A. *Mercedes*, steam yachts *Sapphire*, *Lady Clonell*, *Chimaera*, and *Fauvette*, and the auxiliary motor yacht *Neva*. The *Kite* and *Research* have also been sent round from Portsmouth Dockyard for repairs.

Messrs. J. Samuel White & Co., Ltd., East Cowes, Isle of Wight.—H.M.S. *Basilisk*, ocean-going destroyer, was successfully launched from the builder's yard on the 9th of last month. H.M.S. *Harpy*, a sister vessel, is now nearing completion. H.M.S.'s *Redpole* and *Rifleman* are in frame and last month the keel of the *Ruby* was laid. These vessels are ocean-going destroyers and part of the 1909-10 Naval programme. An equipment of steam boats was completed and delivered last month to the Brazilian battleship *Sao Paulo*, building at Barrow-in-Furness. These comprised two 50-ft. vedette boats, one 30-ft. steam launch, and one 32-ft. steam cutter. Also three 35-ft. steam cutters were delivered recently to H.M. cruisers *Bristol*, *Gloucester* and *Glasgow* respectively at the builders' yards.

THAMES.

(*From our Own Correspondent.*)

The New "Dreadnought."—The order for this vessel having been definitely placed with The Thames Shipbuilding Co., the first preliminary has been the lengthening of the slip for building the big vessel. The pile work is very extensive to guard against the danger of sinking, and many alterations have to be made to allow for the lengthening of the slip. New machinery is being installed to cope with the demands of the contract, and about forty additional draughtsmen are being engaged to cope with the work in the drawing office. The material required has to be assembled before there is any substantial increase in the workshop staff, but when this has been done, nearly 1,000 additional men will be put on, while a similar number will be required in the sheds and shops for preparing plates, angle bars, bends, etc. With the keel plate laid the work will proceed by night and day in order to complete the order within the specified time of two years.

Steamship Lines.—A mild sensation was caused recently by the acquisition by the P. & O. Co. of the Lund line of steamers, comprising five vessels of a tonnage of 20,000. The line known as the Blue Anchor line thus passed to the P. & O. flag consists of the *Geelong*, *Commonwealth*, *Wilcannia*, *Wakool* and *Narrung*. The first two are twin-screw vessels and the rest single-screw, and all are fitted for carrying perishable Colonial produce. They have good passenger accommodation and carry mails between South Africa and Australia. The ill-fated *Waratah* belonged to this line. The P. & O. Co.'s tonnage is thus increased up to 416,197 tons. The Union Castle line have recently had launched for them at Belfast the *Edinburgh Castle*, a twin-screw boat. She is about 585 ft. long and 64 ft. beam, the gross tonnage being 13,400, and the H.P. 12,500 there being cabin accommodation for 700 persons all told. Messrs. Harland and Wolff are the builders. The *Grantully Castle*, recently built on the Clyde, has sailed on her first voyage to South Africa and the *Garth Castle* has recently been launched. These are intermediate boats of about 400 ft. long and a tonnage of 8,000 gross. Both these vessels are fitted with twin-screws, and will trade up the East coast. The additions to the line will therefore be seen to be assuming effective shape.

London Port Dues.—Viscount St. Aldwyn having been appointed by the Board of Trade to hold an enquiry respecting a draft provisional order of maximum dues on goods submitted by the Port of London Authority for confirmation by Parliament, February 24th was fixed as the date of the enquiry. It is contended that the rates fixed are too high and will unduly cripple the trade of the port if passed as suggested, and that allowance should be made on export rates as compared with import, the schedule now proposing the same for both, whereas the value of the exports is only about sixty per cent. of the value of the imports, and that therefore there is room for encouragement to the former. Provincial corporations are taking the matter up as considering their trade with London is affected prejudicially by the proposed increased rates.

The Shipwrights' Co.—This Company had a Court dinner recently under the Presidency of the Master, Lord Pirrie, in which some sixty gentlemen took part. Among these we notice the names of the Hon. Chas. Parsons, Admiral Sir E. R. Freemantle, Sir W. White, Sir J. Wolfe Barry, Engineer Vice-Admiral Oram, Sir Philip Watts and Mr. G. W. Wolff, M.P.

The Marine Society.—Admiral Sir N. Bowden-Smith presided at a Court of Governors recently in the City, and said that during the year 220 boys had been admitted to the *Warspite*, and of those leaving 181 had entered the mercantile marine. The annual meeting will be held this month, at which Lord George Hamilton has consented to take the Chair, at the Fishmongers' Hall.

Death of a London Engineer.—The well-known firm of R. Waygood, Ltd., has lost by death a prominent figure in the person of Mr. W. R. Green, with which firm he had been associated for about fifty years. Previous to taking this position he had served his time as a marine engineer at the firm of Gourlay's in Dundee, and served at sea afterwards in the Royal Navy. His name is closely associated with the fortunes of the well-known firm in the borough.

MERSEY AND MANCHESTER SHIP CANAL

(*From our Own Correspondent.*)

THE improvement in the engineering and shipbuilding trade of this port is being maintained, and though perhaps enquiries are not so numerous for new work large repair contracts have been many, and the orders in hand and recently placed will keep this centre busy for some time to come. The recent disastrous collisions in the Irish Sea have supplied the local yards with additional repair work. The Mersey Dock & Harbour Board, with their progressive policy, are ably seconded by the various shipbuilding and repair yards in maintaining the name of this port as being the greatest, not only for shipping, but also for building and maintaining our naval and mercantile position.

Messrs. Cammell, Laird & Co.—At this extensive yard work has been and continues to be very brisk. Launches have been very frequent of late, the most recent being the last of three destroyers for the British Admiralty, the *Racoon*. This vessel was launched on the 15th Feb., being christened by Mrs. Nelson wife of Mr. William Nelson. The *Renard* and *Wolverine* have already shipped turbines and boilers, and shortly will proceed to the Clyde for speed and consumption trials. H.M.S. *Swift* has completed all trials satisfactorily and at time of writing is leaving for Portsmouth. This vessel is the 36-knot experimental destroyer, and is about 360 ft. long, this length being found essential for the speed. The feature of the month has been the securing of the order for four 32-knot destroyers for the Argentine Government. The propelling machinery is to consist of combination turbines of the "Curtis Parsons" type and the "White Forster" water tube boilers. The order was obtained in competition with British, French and German yards, a striking feature of the design being the heavy armament and number of torpedo tubes in comparison with British practice. The fast boat *Snaefell* for the Isle of Man Steam Packet Co. was launched on the 12th inst. She is of the spar-deck type, and is 270 ft. long, 41 ft. 6 ins. beam, and 24 ft. 3 ins. moulded depth. The speed is expected to reach 19 knots. The "Nelson" boat *Highland Laddie* is practically completed, and the three repeat boats for the same owners are well in hand. The repair department has the *Cheronea* and *Sellasia* in hand. The *Whimbrel*, having been sold to Portuguese

owners, has been docked for overhaul. Contracts recently completed include the oil tank steamer *Saranac*; the Great Western Railway boat *St. George* and the *Kelpie* (the *Kelpie* which was in collision with the s.s. *Garsia* in the river). Of most interest of recent repair work is the *Bassa*, which went ashore in one of the South African rivers, was pumped out and refloated, and after temporary repairs at the nearest port, was docked at Messrs. Cammell, Laird's. About 160 tons of the ship's bottom was dropped out and renewed.

At the Company's Tranmere yard work is proceeding upon the large floating dock for the British Admiralty, the river being dammed back to form a temporary basin, thus avoiding the difficulty of launching such an enormous structure. Work is proceeding rapidly on the two fast turbine steamers for the London & South-Western Railway; launching is to take place in the spring. These boats are being built under the supervision of Prof. J. Harvard Biles for the owners. Amongst recent orders secured at the Tranmere yard are a small tug boat for the Havanna Coal Co., and several small barges for shipment abroad. The *Test* and *Stour*, to replace the destroyers *Blackwater* and *Lee*, will leave the yard shortly to go into commission.

Cunard Line.—This Company have appointed Mr. Alex. Galbraith as assistant to their Superintendent-Engineer. Mr. Galbraith leaves a good position with the Glasgow and West of Scotland Technical School, and previous to this was on the Staff of Messrs. Cammell, Laird & Co. The *Etruria* is now being dismantled in wet dock prior to being towed away to Messrs. Ward's ship-breaking establishment. One cannot help remarking the fine construction in this vessel, now nearly a quarter of a century old. Her sister ship, the *Umbria*, has now taken the place of the ill-fated *Lucania* as spare boat. This latter boat is now being broken up in the Bristol Channel.

Messrs. H. & C. Grayson, Ltd.—This firm's yards on both sides of the river and at Garston are busy. The *Lusitania* is in the Canada Graving Dock for overhaul of turbines and boilers, and has since resumed her sailings. The *Ayrshire* has had her damaged stem removed and new stem and plates are being fitted with the utmost despatch. Other work includes the Great Western Railway Co.'s *Ibex* and *Sir Francis Drake*.

Messrs. Clover, Clayton & Co.—This yard has a large share of repair work on hand. The *Yukon* and *New Pioneer* are in for repairs and overhaul. Recent work includes the repair to the *Segontian Westgarth* and *Pellworm*. The old Wallasey Ferry-boat *Crocus* is in hand, and is being converted into a barge. We understand that the Company has also secured a large repair contract in connection with the dredger *Cornwall*.

Clark's Patents Company are erecting a large automatic coaling plant at Monk's Ferry for rapid coaling of ships of large tonnage. One of the Company's barges recently put between 200 to 250 tons of coal into ship's bunkers in one hour.

The Mersey Docks & Harbour Board have no new work on hand at present. The new ferry extension at Egremont has now been opened some months. The Woodside landing stage was seriously damaged by the s.s. *Craighall*, which, getting out of the control of her tug, cut her way into the stage for a distance of eight feet, just missing the Dock Board's steamer *Salvor*.

Booth Line.—The owners have recently placed orders for four new steamers, Messrs. Scott, of Greenock, having secured one of the *Hilary* type, three others of the intermediate class having been placed with Messrs. Hawthorn, Leslie and Co. of Hebburn. The latter are intended for the River Plate trade freight service, a limited number of passengers being carried.

Canadian Pacific Railway Co. are having two fast boats of moderate dimensions built by Messrs. Bow & M'Lachlan and the Fairfield Shipbuilding and Engineering Co. for service between Victoria and Vancouver.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

H.M.S. "Vanguard."—The "Dreadnought" battleship *Vanguard* has been completed and left Barrow for Devonport on February 12th. During her passage down the channel she underwent her twenty-four hours ⅘ths speed and eight hours. These she passed with flying colours and arrived in Devonport, as far as the contractors are concerned, complete in every detail. This vessel has been built in little over twenty-two months, and from start to finish there has not been a single hitch. Her speed and gun trials were passed through without any trouble, and this means a great deal to contractors. Trials are very costly and before to-day have cost builders thousands of pounds. Here is a vessel that goes through the whole of them with ease. She has been called a lucky ship, but there is more than luck in it. It is due to sound organization, sound practice and up-to-date equipment. Contrary to the general opinion, the *Vanguard* will not be commissioned on March 1st. In the Admiralty specifications the coal ejector and engine intake were placed in the vessel here, the ejector being forward of the intake. The result was that the ashes got into the condenser. This was serious and, of course, will have to be remedied, the intake, it is understood, having to be placed above the bilge keel. This mistake one can hardly credit the Admiralty authorities being guilty of, but nevertheless it is there. No doubt the *St. Vincent* and *Collingwood* will have to be altered also, as they are both from the same design.

The "Princess Royal."—The battleship cruiser *Princess Royal* is to be commenced upon shortly at Messrs. Vickers. It was said at first that this huge vessel was to be named the *Unicorn*, being sister ship to the *Lion*, but for some reason the name has been altered. It is a tremendous contract to squeeze in two years, and so a firm like Messrs. Vickers will be put on their mettle. About 700 ft. long, 86 ft. beam, with a draught of over 27 ft., carrying eight 13·5 guns, she will look a monster. The equipment at Messrs. Vickers' is capable of dealing with a vessel of this size, and the new wharf will be admirably suited for the fitting out of this vessel. By the time she is launched that wharf will be clear of other ships and the dock staff will be able to devote its full time to the work.

200,000 Horse-Power.—It is safe to say that Messrs. Vickers never were so strong in their engineering sheds as at present. First there is the 70,000 h.p. turbine for the Devonport-building battleship cruiser *Lion*, then there is the similar set for the *Princess Royal*, further than this there are the turbines for the cruiser *Dartmouth* of the "City" class, and lastly, the engines for the Brazilian cruiser *Rio Janeiro*. The total h.p. will be close upon 200,000, so one can imagine the amount of work that will have to be dealt with in the next eighteen months or so. There is talk at present of further orders—some from Spain—but nothing certain is public yet. Of course, in due time when the Spanish yards are building the battleships, the big castings will have to be made here for the turbines.

Sooner or later Messrs. Vickers will have to extend their works, and it is more than likely that the extensions will take the shape of new shops for turbine construction. Since Messrs. Vickers took up the building of turbines of the Parsons type they have made tremendous strides, and it is perfectly safe to say that at the present time there is not a firm so well fitted out or so up-to-date in this class of work, and what is more, they are able to build at a minimum cost. They realized some time ago the possibilities of the turbine and absorbed all the experience, practice and knowledge they could on the subject. They gained valuable experience on the turbines of the *Dreadnought*, for which they were contractors.

The Brazilian battleships *Sao Paulo* and the British City class cruiser *Liverpool* are both growing. The *Liverpool* has all her boilers and funnels in, while the *Sao Paulo* is receiving her guns. When the staff returns from the *Vanguard* they will get steam on the Brazilian and try her engines. The huge "Dreadnought" floating dock for Brazil is beginning to assume large proportions on the stocks.

BELFAST.

WITHIN the past month or so orders for a big volume of new tonnage have been placed with Belfast shipbuilders, and they now have sufficient work in hand to keep them busy for some considerable time to come. In

addition to owners who have recently placed orders locally, there are others in the market for steamers, in tendering for which Belfast builders have a very good chance of being successful.

Messrs. **Harland & Wolff.**—Amongst other firms who have recently contracted with the Queen's Island firm for fresh tonnage may be mentioned Messrs. Bibby Bros. and Co., the vessels of whose well-known fleet have all been built here, and the Hamburg-America Co. The latter concern has ordered three vessels of 12,000 tons each. On 27th January Messrs. Harland & Wolff launched from the north end of their yard the magnificent new Union-Castle liner, *Edinburgh Castle*. The vessel is 585 ft. long overall, 64 ft. 8 in. beam, and 42 ft. 6 in. deep, with a gross tonnage of 13,460. Accommodation will be provided for 320 first, 220 second, and 250 third-class passengers. The propelling machinery, which will indicate about 12,500 h.p., consists of two sets of quadruple-expansion engines, having cylinders 32 in., 46 in., 66½ in. and 96 in. by 60 in. stroke.

Messrs. **Workman, Clark & Co.** have also booked some important orders within the last month or two, and are well provided with work. They recently had a successful trial of the new Shaw, Savill & Albion liner *Rangatira*, which is a vessel of 494 ft. in length and about 8200 gross tonnage. The five spacious holds are fully equipped for the rapid handling of cargo. The machinery consists of two sets of triple engines, steam being supplied by five boilers working under an improved system of forced draught.

Messrs. Cochran & Co (Annan), Ltd., have supplied and fitted a Cochran (Annan) donkey boiler with patent seamless furnace to the s.s. *Vincent*, launched by Messrs. Mackie & Thompson, Govan.

Institution of Naval Architects.—The annual meetings of the Institution will take place on Wednesday, March 16th, and the two following days in the hall of the Society of Arts. The annual dinner will be given on March 16th, in the Grand Hall, Hotel Cecil.

Joint Meetings.—International Congress.—H.R.H. the Prince of Wales has graciously consented to accept the Honorary Presidency of the Congress in Naval Architecture and Marine Engineering, which will be held in London on Tuesday, July 5th, and the following days.

The London Foremen Boilermakers' Association. Annual Dinner.—The 18th annual dinner of the London Foremen Boilermakers' Association was held in the Holborn Restaurant on the 20th January, under the Chairmanship of Mr. W. Gibson, with Mr. F. Hughes in the Vice-Chair. The evening was opened with the usual loyal toast, which was heartily responded to. In proposing the toast of the "Association," Mr. C. Hughes, in a few brief remarks, outlined the business of the Association during the past twelve months, and referring to the special branch of the trade they were engaged in, he hoped that during the present year many interesting papers might be read and discussed. Mr. J. Hicks, in responding, said the Association was in a good financial position, and considering the heavy expenses incurred during the past session, he complimented the Treasurer and Secretary on their successful year, this being their first year in office. During the evening, Mr. C. Coates, Past-President, was presented with a case of fish knives and forks by Mr. Gibson on behalf of the Members of the Association. Mr. Gibson said he was very pleased to see the younger Members taking so much interest and responsibility in the work of the Association. Mr. Coates, in thanking the Association for their handsome present, said he hoped he would often be able to be present at their meetings, as he found them most interesting and enjoyable. Mr. J. Ferguson then proposed the toast of the Ladies. Mr. Coates responded, and on behalf of the ladies briefly thanked the Association for their invitation. Mr. Munro proposed the toast of the "Visitors," and Mr. McKenzie suitably responded on behalf of the visitors. During the evening an excellent musical programme was given by Messrs. Munro, F. Hughes, Downey, Anderson, Palmer, Downey, jnr., J. Snodery, J. Abercrombie, Price and Mosey. Some interesting items were also contributed by Miss Hyde and Miss Maud White (Elocutionist).

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Larchwood.—On January 24th, Messrs. W. Harkess and Son, Ltd., launched from their yard at Middlesbrough a screw steamer 180 ft. by 29 ft. 10 in. by 13 ft. 2 in. moulded, which has been built to the order of Messrs. The Meteor Steamship Co., Ltd., of Middlesbrough. She is designed with large cubical capacity to carry 900 tons on a light draught. Her engines will be fitted by Messrs. Blair & Co., Ltd., of Stockton-on-Tees. She has been built under the superintendence of Mr. William Constantine.

Hilda.—On January 26th, Messrs. Wm. Doxford & Sons, Ltd., launched from their Pallion yard the s.s. *Hilda*, built to the order of Messrs. Mark Whitwell & Son, Bristol. She is classed with the British Corporation in their highest grade. She is constructed on modern lines with deep frames, extra thick steel and steel centre bulkhead and carries a poop, long bridge and topgallant forecastle, giving her a very high capacity. Her deadweight carrying capacity is 6300 tons on 21 ft., being especially adapted for up-river work on the Plate and similar purposes. She will have triple engines and high-pressure boilers, giving her a speed of 10 knots. She is now being engined by Messrs. Doxford.

Mohacsfield.—On January 26th, Messrs. William Gray and Co., Ltd., launched the handsome steel screw steamer *Mohacsfield*, which they have built for The Doughty Shipping Co., Ltd. (Messrs. H. Doughty & Co., of West Hartlepool, managers). She will take the highest class in Lloyd's Register and is of the following dimensions *viz.*:—Length, overall, 381 ft. 6 in.; breadth, 51 ft. 6 in., and depth, 24 ft. 4½ in with extra long bridge, poop and topgallant forecastle. The saloon, state-rooms, captain's, officers' and engineers' rooms, etc., will be fitted up in houses on the bridge deck and the crew's berths in the forecastle. The hull is built with deep bulb-angle frames, cellular double bottom and large aft peak ballast tank, eight steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25½ in., 40½ in. and 67 in. dia., with a piston stroke of 45 in. and two large steel boilers for a working pressure of 180 lbs. per square inch.

Tamele.—On January 26th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, launched from their Middleton Shipyard the steel screw steamer *Tamele*, the sixth vessel built for Messrs. Elder, Dempster & Co., Liverpool, and one of the three passenger and cargo vessels at present under construction at Middleton Shipyard, being the tenth steamer built under Sir C. Furness's co-partnery scheme. The *Tamele* is a beautifully modelled vessel, having very fine lines, and is specially designed with main, upper and shelter decks. The vessel is otherwise strengthened to suit the owner's West African trade. The dimensions are:—Length, 375 ft.; beam extreme, 50 ft., and depth moulded, 25 ft. 3 in. to upper deck, having all the 'tween decks and houses 8 ft. in height. She is classed 100 A1 at Lloyd's, and has cellular double bottom all fore and aft with fore and after-peak tanks for water ballast. The vessel is divided into seven water-tight compartments by means of six transverse bulkheads and every attention has been paid to all appliances for the rapid loading and discharging of cargo, the ship having nine powerful steam winches of the builders' own design, and ten derricks capable of lifting five tons each; provision is made on each mast for a special derrick dealing with 50-ton loads, whilst the whole of the mast arrangement is strengthened to lift 40 tons. Accommodation for thirty first-class is arranged under the bridge, second-class passengers at the after end under the poop. The vessel has steel decks sheathed with wood on the poop, bridge, forecastle and promenade decks. The vessel is fitted with the usual complement of lifeboats, together with six surf boats of special design for carrying palm oil through the surf. A complete installation of electric light will be fitted by Messrs. Campbell & Isherwood, including signal lamps, binnacle

lamps, cargo clusters at each hatch, as well as oil lamps for emergency purposes. Steam-steering gear is placed amidships and a quick-warping steam windlass forward, steam being supplied to all deck machinery and auxiliaries from either of the three main boilers. The engines are of the triple-expansion type by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 25 in., 40 in., 68 in. by 48 in. stroke with three main boilers working at a pressure of 180 lbs., and capable of driving the vessel at a fair rate of speed when loaded. A "Contraflo" condenser will be fitted, by which a vacuum of 27 in. can be carried in sea water up to 85 degrees, so that the engines will always develop the horsepower intended and give the best results in speed and consumption. Owing to the lamented death of Sir Alfred Jones, the late and most respected chairman of Messrs. Elder, Dempster & Co., and who was a staunch supporter of the co-partnery scheme, the vessel has been banded with a blue ribband as a sign of mourning and she was quietly put into the water without a christening ceremony.

Glencliffe.—On January 27th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., launched from their Harbour Dockyard, West Hartlepool, the steel screw steamer *Glencliffe*, built to the order of Messrs. Milburn, Lund & Co., Whitby, and the eleventh steamer built under Sir Christopher Furness's co-partnery scheme. The *Glencliffe* is 360 ft. in length by 51 ft. beam by 25 ft. 6 in. depth moulded, carrying 6,400 tons on the light draught of 21 ft. 5 in. The vessel is of the single-deck type, having absolutely clear holds, with poop, bridge and forecastle, and is built to the highest class at Lloyd's. Cellular double bottom is fitted throughout and she has large fore and after-peak tanks for water ballast, and is constructed with deep frames and longitudinal stringers giving clear holds for the stowage of bulky cargoes and is divided into seven water-tight compartments by means of six water-tight bulkheads. Wood grain divisions are fitted throughout the holds according to the latest Board of Trade requirements. Four extra large hatches are provided, with eight powerful steam winches worked from a multitubular donkey boiler, and all the latest improvements are included for the rapid loading and discharging of cargo. A powerful quick-warping windlass is fitted forward, and steam-steering gear amidships, hand-screw gear aft. Triple-expansion engines by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, will be supplied and fitted, the sizes of cylinders being 25 in., 40 in., 67 in. by 45 in. stroke, with two boilers 16 ft. 6 in. by 11 ft., working at a pressure of 180 lbs. per square inch. A "Contraflo" condenser will be fitted by which a vacuum of 27 in. can be carried in sea water up to 85 degrees, so that the engines will always develop the horsepower intended and give the best results in speed and consumption.

Treverbyn.—On February 9th, there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, a steel screw steamer built to the order of Messrs. Edward Hain & Son, St. Ives, Cornwall, and named the *Treverbyn*. The vessel is of the improved single-deck type to Lloyd's highest class and under their special survey, having poop, long bridge and topgallant forecastle, with deep girder framing and having cellular double bottom all fore and aft, and with large after-peak tank for water ballast. The outfit of the ship is very complete for general and grain trades, with shifting boards all fore and aft, and trunk feeders as hatchways. A full equipment of steam winches and derricks is fitted for the rapid loading and discharging of cargoes. The vessel has been built to carry a deadweight cargo of 7100 tons on a light draught of water. The vessel will be fitted with triple-expansion engines, also constructed by Messrs. John Readhead and Sons., Ltd, having cylinders 25½ in., 42 in. and 69 in. and 48 in. stroke, supplied with steam from two large steel boilers working at a pressure of 180 lbs. per square inch.

Indutionare.—On February 9th, Messrs. Wm. Pickersgill and Sons, Ltd., launched from their shipbuilding yard at Southwick, Sunderland, a finely modelled screw steamer, built to the order of the Antwerpsche-Zeevaart-Maatschappij Co., Ltd. (Messrs. J. D'Haene & Co.), Antwerp. Her principal dimensions are:—Length, 260 ft.; breadth, 30 ft. 3 in.; depth, 19 ft. 9 in., and she is built under special survey to take Germanischer Lloyd's highest class. The vessel is built on the deep bulb-angle frame principle, as a single decker with long full poop and topgallant forecastle, and is fitted with cellular bottom throughout, while the after peak is also arranged for water ballast. The fore-end strength is considerably increased to enable her to frequent ice-bound ports. Four extra large hatches are arranged with winches and derricks for lifting heavy weights. The pillars at sides of hatches have been dispensed with, so as to leave large clear holds, and the deck arrangements have been specially considered with a view to carrying large deck loads of timber. She is also fitted with steam windlass, and steam-steering gear, which is fitted in the engine casing, with controlling shafting to wheel on pilot bridge. She will be rigged as a fore and aft schooner, with steel lower masts and wood topmasts. The machinery is being supplied by Messrs. MacColl and Pollock, Ltd., of Sunderland, being of the triple-expansion type, and having cylinders 19 in., 31 in., 52 in. by 36 in. stroke, steam for which will be supplied from two large steel boilers with a working pressure of 180 lbs.

Birchwood.—On February 10th, Messrs. Ropner & Sons, Ltd., Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*:—Length, 328 ft.; breadth, 45 ft. 8 in.; depth, 23 ft. 6 in. The vessel will be classed 100 A1 at Lloyd's, having main deck, poop, bridge and topgallant forecastle. The vessel has double bottom for water ballast on the cellular principle and in after peaks. She will be fully equipped with an up-to-date outfit, including quick-warping steam windlass, stockless anchors, steam-steering gear amidships, and powerful screw gear aft. The appliances for loading and discharging cargoes expeditiously are very complete and include six steam winches, steam being supplied by a large donkey boiler. The holds are entirely clear of obstructions to stowage of cargo, having centre line pillars only. The engines will be of the triple-expansion type by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, of about 1100 i.h.p., having two steel boilers 14 ft. 9 in. by 10 ft., 160 lbs. steam pressure. The vessel has been built to the order of Messrs. W. W. & W. Constantine, of Middlesbrough.

Octo.—On February 11th, Messrs. Short Brothers, Ltd., launched from their shipyard at Pallion, Sunderland, the steamship *Octo*, built to the order of the Aktieselskabet Hekla, of Christiania. The vessel, which is constructed on the deep frame principle with one deck laid, will take Lloyd's highest class, and is of the self-trimming type with extra large hatchways. Her dimensions are—Length, 269 ft., beam 37 ft. 9 in., and depth moulded 20 ft. 4 in. Water ballast is provided throughout the cellular double bottom and in the fore and after peaks. Fore and aft central longitudinal steel bulkhead is fitted between hatchways, with wood shifting boards in way of hatchways. Pillars at hatch sides are dispensed with to enable large pieces of machinery to be shipped. Five steam winches, steam windlass, steam-steering gear controlled from standards in wheelhouse and on upper flying bridge and connected by rods and chains to quadrant are supplied, taking steam from a "Horace" patent donkey boiler fitted in stokehold. The machinery is by The North-Eastern Marine Engineering Co., Ltd., Sunderland, and consists of engines with cylinders 19 in., 31 in., 51 in. dia., and a stroke of 36 in., driven by a large multitubular boiler of 16 ft. by 10 ft. 6 in., 180 lbs. pressure.

LAUNCHES—Scotch.

Trabboch.—On February 9th, Messrs. Archd. McMillan and Son, Ltd., shipbuilders, Dumbarton, launched the steel screw steamer *Trabboch*, which they have built for Liverpool owners. The vessel, which is of the single-deck type, is of the following dimensions:—Length, 364 ft.; breadth, 50 ft.; depth moulded, 28 ft. 13 in., and is constructed on the Isherwood principle, the whole arrangements being of a superior description. The machinery is being supplied by Messrs. David Rowan & Co., Glasgow, and both vessel and machinery have been built under Lloyd's special survey. During construction the steamer has been under the supervision of Mr. R. J. Williams, Liverpool.

Levuka.—On February 10th, Messrs. Alex. Stephen and Sons, Ltd., Linthouse, launched a twin screw steel steamer of about 7000 tons, built to the order of the Australasian United Steam Navigation Co., Ltd., for the Australian coasting and Pacific trade. The vessel is very similar to the

Wyreema, built by Messrs. Stephen in 1908 for the same owners, but she is slightly larger, being 400 ft. by 55 ft. beam by 41 ft. depth, and differs in an important particular, *viz.*, that the greater portion of the cargo spaces of the new ship are insulated and fitted with Hall's cold-air system for the carriage of perishable fruit. The builders, who have had considerable experience in the construction of this type of steamer, have arranged the fruit spaces on the same lines as in the numerous vessels built and fitted up by them for the fruit-carrying trade. The cargo is handled by hydraulic cranes and derricks as in the other vessels of the A.U.S.N. Co., and the fruit holds are loaded and discharged by hydraulic hoists specially designed for the purpose by Messrs. Stephen. A strong steel derrick is also fitted to lift heavy machinery by means of two powerful steam winches. In addition to the air-cooled fruit holds, large refrigerated provision chambers are fitted—the installations for cargo and provisions being kept entirely separate. The passenger accommodation is generally similar to the *Wyreema*, and is divided into first and second classes. The propelling machinery, which is also supplied by the builders, consists of two sets of quadruple-expansion balanced engines, and an ample supply of steam is provided by six large boilers. The outfit of auxiliary machinery is of a most extensive and modern type. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering was applied to the tank top in boiler-room and deck in cooler rooms, and their "Bitumastic" enamel to the bunkers and boiler-room tank.

John Bacon.—On February 12th, Messrs. Murdoch and Murray launched a steel screw steamer for Messrs. John Bacon, Ltd., Liverpool, one of the longest established shipowning firms in this country. The steamer has been built for the Company's passenger and cargo service, having accommodation for fifty first-class passengers and deck shelter for steerage passengers. Cattle fittings are arranged on three decks, and generally the vessel is complete to all modern requirements. Messrs. Muir & Houston will supply triple engines of large power.

Venture.—On February 15th, there was launched from the yard of Messrs. Napier & Miller, Ltd., Old Kilpatrick, the handsome steel twin-screw passenger steamer *Venture*, built to the order of the Boscowitz Steamship Co., Ltd., Victoria, B.C. The dimensions of the vessel are:—Length, 180 ft.; breadth, 32 ft.; depth, 19 ft., with a gross tonnage of about 1000 tons, built under the rules of Lloyd's Register for their highest class. The vessel is rigged as a two-masted schooner, has upper, awning and promenade decks, water ballast in double bottom, deep tanks and fore and aft peaks. On the awning deck a large deck house has been built for the accommodation of sixty first-class passengers. The necessary hatches with four specially constructed steam winches for the rapid handling of cargo, a feature of these winches being that two of them can easily be operated by one man, thus making for economy in working, and large side cargo doors have been fitted, also steam windlass, steam-steering gear and steam-warping capstan aft. A very complete installation of electric lighting and steam heating has been fitted. The machinery, which is being supplied by Messrs. Miller and Macfie, Ltd., Stanley Engine Works, consists of triple-expansion engines with cylinders 12 in., 19 in., 33 in. with 27 in. stroke, and two boilers of large size, 180 lbs. working pressure. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the boiler-room tank, also bilges in boiler-room, and their "Bitumastic" covering to the tank top in boiler-room. Messrs. Matthew Keenan & Co., Ltd., of London and Glasgow, have the contract to cover all the boilers and steam pipes on board.

LAUNCHES—Irish.

Edinburgh Castle.—On January 27th, Messrs. Harland and Wolff launched the *Edinburgh Castle*, built to the order of the Union Castle Line. The *Edinburgh Castle* is 585 ft. 9 in. overall, 64 ft. 8 in. beam, 42 ft. 6 in. deep, with a gross tonnage of about 13,400 tons, and 12,500 i.h.p. The vessel is fitted with twin screws. She is constructed of steel throughout to the requirements of Lloyd's Register, with special regard to stability and safety. The cellular double bottom extends the full length of the ship, and the holds are subdivided into separate compartments by water-tight bulkheads, a double collision bulkhead being fitted forward. As the vessel lay on the stocks the fine lines and handsome model of the immense hull were much admired, and as she lay at rest in the water after the launch the practised eye could easily imagine how graceful she will be with her two elliptical funnels and raking pole masts. In the arrangements for the comfort of passengers every modern improvement has been taken advantage of, both in the general design and in the vessel's fittings and appointments. The cabin accommodation is as follows:—First-class, about 320; second-class, about 220; third-class, about 250. The first-class state-rooms will be on the upper and main decks, the larger number being arranged for two passengers, while on the promenade deck there will be a group of large handsome state-rooms, which can be divided into suites of two, three or four rooms. On the main deck there will be a saloon specially provided for children, conveniently arranged and suitably furnished. The public rooms will be large commodious apartments and arranged so as to ensure the maximum of comfort and the most perfect service. The second-class public rooms and accommodation have also received special consideration, containing saloon, library, smoke-room and state-rooms, and the third-class accommodation is likewise of a very superior type. Of course, on a vessel trading to South Africa, deck space for games and promenading is an important feature, and in the *Edinburgh Castle* the deck space at the disposal of all classes of passengers has been very liberally provided. The arrangements with regard to baths, sanitary accommodation, etc., are of the most perfect character, and a continuous service of fresh water passing through a special filter will be supplied throughout the ship. Needless to say, electricity enters very largely into the means provided on board this great liner for ventilation, by electric fans, and also for other purposes. The storage rooms are very commodious, and the vessel has a large refrigerating plant. The arrangements for working ship and cargo are of the latest type.

TRIAL TRIPS.

Protesilaus.—An important addition to the large fleet of Messrs. Alfred Holt & Co. was tried at sea off the Tyne recently, and the results obtained showed that the vessel is certain to maintain the high standard of her owners and of the builders, Messrs. R. & W. Hawthorn, Leslie & Co., Ltd. She is of the highest class of cargo boat, and when fully loaded will carry a deadweight of 13,000 tons and has comfortable accommodation for about 580 emigrants and a limited number of 1st-class passengers. The intention of the owners is to run the *Protesilaus* in their Far Eastern trade, and the cargo arrangements and gear have all been designed to make the vessel specially suitable. The holds, of which there are seven, are pillared so as to leave them as spacious as possible for the carriage of bulky general cargo, such as railway cars, boilers, etc., and the discharging gear consists of twenty-six powerful winches actuating thirty-one derricks, which are capable of lifting weights up to 50 tons. A distinctive feature in the appearance of the ship is the massive derrick posts, which are placed two forward and two aft at each side of the ship, the two forward ones being joined by a bridge at a height of about 75 ft. above the water line. Electric light is fitted throughout the vessel with special arrangements at the hatches to allow of the speedy discharge of cargo during the night. The machinery has been constructed by the North-Eastern Marine Engineering Co., at Wallsend, and consists of two sets of triple-expansion engines, the dimensions of the cylinders being 23 in., $38\frac{1}{2}$ in., 65 in. by 48 in. stroke, the steam being supplied at a pressure of 180 lbs. from two large double-ended boilers and one single-ended auxiliary boiler, the main boilers being fitted with Howden's system of forced draught. The trial was thoroughly successful and the owners' representatives expressed themselves as being highly satisfied with the way the builders had carried out their contract. The *Protesilaus* is the fifth vessel built by Messrs. Hawthorn, Leslie for Messrs. Holt within the last five years.

Rochester City.—All who are acquainted with the exacting requirements of up-to-date coal carrying in the coasting trade are well aware that the first of these is absolute self-trimming, so as to avoid all hand labour. Next, that the hatchways shall be of the largest possible size. Next, that the discharging shall be done by means of the ship's own gear, either overside the ship into barges or into railway

trucks on the quay in the most expeditious manner. Next, for the homeward voyage when the vessel is carrying no return cargo, that there should be ample water-ballast to immerse the propeller. Finally, that the net register tonnage shall be as low as possible. All these desiderata have been kept in view and practically achieved as will be shown below, in the s.s. *Rochester City*, built by Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, Middlesbrough, on the well-known patent cantilever type, to the order of Mr. W. A. Watson, of Sunderland, to be regularly employed in the coasting coal trade, which proceeded to sea on the 1st of Feb. Her leading dimensions are 240 ft. by 35 ft. 3 in. by 17 ft. 8 in. moulded, and she carries 1900 on 15 ft. 6 in. draught. Her hatchways are 22 ft. wide, the longest of these 35 ft. long. They are absolutely self-trimming so that all the crew will have to do is to level the top of the coals in the hatchways and no trimmers are required for the bunkers. The holds are clear of any obstruction such as pillars or beams, so that the grabs can reach any part of them, which grabs are worked by means of four powerful steam cranes on deck and swung over the side of ship and thus can discharge the cargo very rapidly. The trial trip of the *Rochester City* passed off most successfully, and she has recently proceeded on her first voyage under the command of Captain A. Hardy. (Account of launch, see January issue.)

Zurichmoor.—On January 24th, the new screw steamer *Zurichmoor*, built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of Messrs. Walter Runciman & Co., Newcastle-on-Tyne, was taken to sea on her official trial trip. The trial was in every way satisfactory to all concerned. The vessel afterwards proceeded to Cardiff to load under the command of Captain Stonehouse. (Account of Launch, see January issue.)

Himalaia.—On January 31st, the finely modelled screw steamer *Himalaia*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of D. Tripcovich, Esq., of Trieste, left the Tyne to undergo her official trial trip. The loaded trial trip proved in every way highly satisfactory, and a speed of over 11 knots was easily maintained. (Account of Launch, see January issue).

Professor.—On February 2nd, the new steamer *Professor*, built and engined by Messrs. Workman, Clark & Co., Ltd., Belfast, to the order of Messrs. T. & J. Harrison, of Liverpool, left Belfast Harbour for a cruise in the Lough, during which the compasses were adjusted and speed trials run. The propelling machinery is of the latest type of triple-expansion engine with the necessary auxiliary appliances and supplied with steam from three steel cylindrical multitubular boilers. (Account of Launch, see January issue.)

Rangatira.—On February 7th, the new twin screw steamer *Rangatira*, built and engined by Messrs. Workman, Clark and Co., Ltd., Belfast, for the Shaw, Savill and Albion Co., Ltd., London, left the builders' wharf at Milewater Basin and proceeded down the Lough for adjustment of compasses and to undergo her speed trials. The results of the trial runs on the measured mile proved to be highly satisfactory, and the equipment of auxiliary machinery all worked smoothly and well. (Account of Launch, see February issue.)

Plutus.—On February 8th, the s.s. *Plutus*, of about 2200 tons d.w., built by the Campbeltown Shipbuilding Co., and engined by Messrs. D. Rowan & Co., Glasgow, for Messrs. J. & P. Hutchison, of Glasgow, ran loaded trial trip at Wemyss Bay. The *Plutus* is of the well deck type, with raised quarter deck, bridge and topgallant forecastle, is built in excess of Lloyd's highest class, and is specially arranged for the timber and general trade. After the trial, which was in every way satisfactory, the vessel proceeded to sea.

Bjornstjerne Bjornsen.—On February 9th, the steel screw steamer *Bjornstjerne Bjornsen*, built by Messrs. Wm. Gray and Co., Ltd., to the order of Mr. Vilhelm Torkildson, of Bergen, Norway, had her trial trip. The vessel and her machinery have been built under the superintendence of Mr. O. L. Dahl and Captain J. S. Reinertson, and these gentlemen represented the owner on the trial; the British Corporation were represented by Mr. Halvort, the shipbuilders by Mr. Brydon, junr., and the engine builders by Mr. Maurice S. Gibb. After the usual manœuvring for adjustment of compasses, etc., the vessel was taken to the Tyne to load, and on the way round averaged a speed of 10½ knots, everything working satisfactorily. (Account of Launch, see February issue.)

Zinovia.—On February 16th, the handsome steel screw steamer *Zinovia*, built by Messrs. Wm. Gray & Co., Ltd., to the order of Messrs. Michalinos & Co., of London and Piræus, had her trial trip. A run along the coast was made to Whitby, during which the average speed was 11 knots, everything working satisfactorily. The vessel afterwards proceeded to Newport to load. (Account of Launch, see Feb. issue.)

Boverton.—On February 16th, the steel screw steamer *Boverton*, built by Messrs. The Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on-Tyne, for Messrs. Evan Thomas Radcliffe & Co., of Cardiff, left the Tyne for her official trial trip. During the trial the machinery ran without a hitch and a mean speed of 10 knots was easily maintained, giving great satisfaction to all concerned. (Account of Launch, see January issue.)

Benbrook.—On February 16th, the finely modelled steel screw steamer *Benbrook*, built by Messrs. Craig, Taylor and Co., Ltd., Stockton-on-Tees, to the order of Joseph Hoult, Esq., of Liverpool, underwent her trial trip, which proved highly satisfactory in every way. The owner was represented on the trial trip by Mr. B. Allen, of Liverpool, under whose superintendence the vessel has been built. (Account of Launch in February issue.)

Ramsgarth.—On February 17th, the fine steel screw cargo steamer *Ramsgarth*, built by Sir Raylton Dixon & Co., Ltd., at their Cleveland Dockyards, Middlesbrough, to the order of Messrs. R. & J. H. Rea, of Liverpool, Cardiff and Southampton, proceeded to sea to undergo her official trials. The trials passed off most successfully and the vessel proceeded to the Tyne under command of Captain Ralph Johnson, to load. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted. (Account of Launch in February issue.)

FOREIGN TRIAL TRIPS.

Breidablik.—On February 4th, the steel screw cargo steamer *Breidablik*, built by the Laxevaags Engineering and Shipbuilding Co., Bergen, went for her trial trip and after compasses had been adjusted, proceeded to the measured mile, where a series of trials were run and a mean speed of 10½ knots attained. The steamer is of the following dimensions:—Length extreme, 230 ft. 6 in.; breadth, 35 ft.; depth moulded, 16 ft. 10 in.; d.w. carrying capacity, about 1775 tons. The engines, which also have been constructed by the Laxevaags Co., are of the triple-compound type with cylinders 16 in. by 25½ in. by 43 in. by 30 in. stroke. Working pressure 175 lbs. per square inch. The vessel is built for Messrs. Johan C. Giertsens Ettf. (Messrs. Schelderup and Schjott), Bergen.

THE JUNIOR INSTITUTION OF ENGINEERS.—At a recent meeting of this Institution held at the Royal United Service Institution, Whitehall, the chairman, Mr. Geo. T. Bullock, presiding, the honorary member's lecture of the year was delivered by Mr. R. H. Hammersley Heenan, M.Inst.C.E., late consulting engineer to the Harbour Commissioners of Port Elizabeth, who took as his subject "The creation and development of a successful commercial port." With the harbour of Algoa Bay, or Port Elizabeth, as an illustration, the lecturer showed how great natural difficulties could be overcome in port development and provision made for a satisfactory harbour. Both failures and successes were considered in the course of the lecture, reference being made to the breakwater of 1856, the design for docks in the bay in 1870, jetties and sea walls, mode of working the port, improvement of jetties, landing stage for explosives, hydraulic dock, slipway, land reclamation and fishing interests. The effects of improvements and the results of experience were dwelt upon, and the lecturer concluded with an interesting review of the various projects which had been put forward from time to time, including the latest proposal of Messrs. Coode, Son & Matthews, the breakwaters of which would enclose an area of 740 acres, the general design being one recommended to the Harbour Commissioners by Mr. Heenan some years previously. When those great works would be carried out it was hard to say, but it was even more difficult to imagine that a country with the enormous potentialities of South Africa, and with an enterprising and energetic people, would neglect to develop, when a suitable time arrived, one of the most important ports which it possessed.

BOARD OF TRADE EXAMINATIONS.

1910 — Extra First Class.

Feb 3rd—Brett, R.	.. ..	Ex 1C London
,, 3rd—Campbell, R S.	..	Ex 1C N Shields
,, 3rd—Cothay, F H	.. ..	Ex 1C Sunder'ld
,, 3rd—Curr, T. ..	.. ..	Ex 1C London
,, 3rd—Daish, H H. R. ..	..	Ex 1C N Shields
,, 3rd—Meggitt, A H. ..	..	Ex 1C Hull
,, 3rd Newman, C. W D.	..	Ex 1C Cardiff
,, 3rd—Page, J. S.	.. ..	Ex 1C Dundee
,, 3rd—Thirkell, C. H. ..	..	Ex 1C Sunderl'd

NOTE—1C denotes First Class: 2C Second Class.

December 24th, 1909.

Annear, J E. .. 1C Cardiff
Armitage, J .. 2C Cardiff
Barr, W H .. 2C Glasgow
Barron, T .... 1C N.Shields
Bird, H H. .. 2C W. Hart'l
Bradley, J. .... 1C N.Shields
Bryant, W P 2C Cardiff
Cairns, A .... 2C Leith
Cameron, R. .. 2C Glasgow
Campbell, T B. 1C N Shields
Couch, S. G .. 1C Liverpool
Cousins, H. G 2C Cardiff
Cranston, A P. 1C Leith
Dawson, R H 2C London
Duke, W....... 1C Liverpool
Esdon, H. ..... 1C N Shields
Ferguson, P. .. 1C Glasgow
Glen, J S .... 2C Glasgow
Grant, W. D .. 2C South'ton
Greig, A ...... 1C Leith
Gummer, C G 2C London
Hewitson, C .. 2C W Hart'l
Hull, C ...... 1C South'ton
Jones, W ...... 1C W Hart'l
Kinread, L R 1C Liverpool
M'Donnell, S 1C Barrow
M'Kenzie, W J 1C Glasgow
Maxwell, W .. 2C Liverpool
Merrick, R H. 2C Cork
Miller, A H .. 2C Glasgow
Moss, G S..... 1C London
Nelson, N P .. 2C Glasgow
Owen, N ...... 1C Cardiff
Patterson, G A 2C Liverpool
Patton, J ...... 1C N Shields
Pettersen, A .. 1C Glasgow
Price, J. C..... 2C Liverpool
Rees, T H .... 1C Cardiff
Roberts, D G 2C Liverpool
Rogers, F G .. 2C Leith
Scott, F ...... 2C Leith
Shaw, A T .. 2C London
Shee, H J .... 2C London
Smith, W .... 2C N Shields
Stanley, J. .... 2C W. Hart'l
Steward, J. H 1C N Shields
Stobo, J ...... 1C Glasgow
Summers, W J 1C Liverpool
Thayen, C H 1C Liverpool
Thompson, J.M 1C Glasgow
Thomson, R .. 1C Leith
Turner, W.... 1C W. Hart'l
Twist, E. C. .. 1C W Hart'l
Wadsworth, E R 2C Liverpool
Watson, J. .... 1C N Shields
Whale, S. M .. 1C Leith
Williams, E .. 1C Liverpool
Wilson, W D 1C Glasgow
Wood, G. J G. 1C Liverpool

December 31st.

Anderson, T. J 2C Aberdeen
Bissett, J ...... 1C Aberdeen
Bissett, J J .. 2C London
Blease, W J .. 1C Liverpool
Bucknall, P. H. 2C Liverpool
Cameron, R. W. 2C Aberdeen
Chazifotion, T 1C Sunderl'd
Cockburn, G. T 2C N.Shields
Cooper, T .... 2C Liverpool
Cowie, G. .... 2C N Shields
Cumming, A. B 2C Greenock
Cunningham, R. 1C Aberdeen
Davidson, T R 2C Aberdeen
Dockwrey, W M 2C N Shields
Ellis, R. M .. 1C Liverpool
Galloway, R .. 1C Sunderl'd
Galway, R .... 2C London
Gidley, G. H .. 2C Sunderl'd
Harrison, C. E. 1C Sunderl'd
Hartje, L .. 2C Liverpool
Haslam, R .... 1C Liverpool
Hoare, R. E .. 1C Bristol
Holland, E J 2C Sunderl'd
Ireland, G .... 1C Aberdeen
Johnson, E A 2C N.Shields
Jones, G F .. 1C Liverpool
Kent, J J. .... 1C Greenock
Lake, G B .... 2C London
Lambert, M H 1C N Shields
Logan, G A .. 2C London
M'Leod, J .... 2C Greenock
Marsh, J .... 2C Liverpool
Mellentin, R .. 1C Sunderl'd
Miller, J....... 2C Liverpool
Nelson, W. B 1C Sunderl'd
Ogle, E. J. .... 2C London
Palmer, F B .. 1C Hull
Perry, S E. .. 2C Hull
Robertson, D .. 1C Greenock
Sampson, S H 2C Hull
Scarfe, J. J .... 1C N.Shields
Shahbasian, O 1C Greenock
Smith, A J .. 2C London
Stobo, W R. .. 2C Greenock
Stratton, H .. 1C London
Sutherland, T S 1C Aberdeen
Tennent, G .. 2C Greenock
Theodorides, G 1C Greenock
Turvey, J F .. 1C Liverpool
Wild, R B..... 2C N Shields
Williams, E .. 2C Sunderl'd
Woodger, S. G 2C Hull
Wyllie, G. .... 2C Aberdeen
Usher, H A .. 2C Sunderl'd

January 7th, 1910.

Arnold, W. .... 1C Cardiff
Banner, W. J... 2C Cardiff
Beer, E L .. 2C Falmouth
Bell, R M .... 2C Glasgow
Campbell, J .. 1C Belfast
Colquhoun, W 2C Glasgow
Cothay, F. H .. 1C N.Shields
Dick, J. A .... 1C Leith
Duff, P. M .... 2C Leith
Duncan, F L .. 2C London
Fairgrievo, J .. 1C Leith
Ferguson, P. M 1C Glasgow
Ford, J. G. .... 1C Glasgow
Grimshaw, A .. 1C Belfast
Heron, G. .... 1C Glasgow
Hoffmann, F .. 2C Belfast
Lingard, T. M 2C Leith
Lydon, J ...... 2C Leith
Nash, E F..... 1C Cardiff
Neill, C... .... 2C Belfast
Paterson, R .. 1C Glasgow
Pile, G ...... 1C Cardiff
Powrie, A .... 1C Glasgow
Prince, P. H .. 2C Glasgow
Pritchard, A. G 2C Cardiff
Rawlinson, C.H. 1C London
Robertson, J W. 2C Glasgow
Robson, C.L W. 1C Cardiff
Smith, J. T. .. 2C Glasgow
Smith, N .... 2C Glasgow
Sutherland, W. 2C South'ton
Wallace, T..... 2C Glasgow

January 14th.

Ashton, H. J .. 2C Liverpool
Cogdell, H .... 2C Liverpool
Cornell, W .. 2C London
Cundall, N .... 1C Hull
Daley, D. .... 2C Liverpool
Davis, W. K .. 1C Liverpool
Duncan, A I .. 2C Liverpool
Evans, W J. .. 1C Liverpool
Fairlem, H J 1C Liverpool
Farrell, R J .. 1C Liverpool
Ferguson, F. A 1C Liverpool
Garlick, T.W F 1C London
Hayhurst, T W 1C N Shields
James, S ...... 2C Greenock
Johnston, J .. 1C Greenock
Johnston, W J 2C Greenock
Jones, W. D .. 1C Liverpool
Logan, T .... 1C London
Lythgoe, W .. 1C Liverpool
M'Cadames, R 1C London
Mitchell, R. .. 1C N Shields
Paterson, A. M 2C Greenock
Reddoch, A. .. 2C Greenock
Reed, G. H .. 2C N Shields
Thompson, A... 1C Liverpool
Wilson, C F .. 1C N Shields

January 21st

Alder, P. ...... 1C Cardiff
Barlow, H. A .. 1C South'ton
Beeny, W. M 2C Cardiff
Broughton, E. 1C W Hart'l
Campbell, J. .. 2C Glasgow
Calnon, L C... 2C W. Hart'l
Cozens, J. W .. 1C Liverpool
Crighton, A. E 2C South'ton
Daglish, G .... 2C N.Shields
Davies, E .... 1C Cardiff
Davies, W C... 2C Liverpool
Dennis, W .... 1C Glasgow
Derry, G P. .. 2C London
Ennels, L J .. 2C London
Gray, A S .... 2C South'ton
Hayes, C S .. 2C London
Heald, W. D .. 1C Cardiff
Hobbs, A .... 2C South'ton
Johnston, W S 1C Leith
Jordan, A E .. 2C London
Lynd, E. C .. 1CB-in-Frns.
Mallet, J. J .. 1C N.Shields
Marshall, H. H 1C Leith
Middleton, W C 1C B in Frns
Millard, G. E 2C South'ton
Mudie, D G .. 1C Leith
Phillips, J C .. 2C Liverpool
Reid, W....... 1C Liverpool
Richer, S T .. 2C London
Ritchie, J .... 1C Leith
Rodgers, J. M 2C Glasgow
Sharp, D D .. 1C Glasgow
Simpson, H J 2C W. Hart'l
Stein, W. M .. 1C Glasgow

January 28th

Adams, A. J. .. 2C Liverpool
Barwick, F .... 1C Sunderl'd
Burns, W. M... 1C N.Shields
Campbell, D. P 1C Londn'ry
Campbell, J .. 1C Greenock
Carrigan, T. .. 2C London
Carter, F. .... 1C London
Chambers, J W. 1C N.Shields
Clark, C. W. .. 2C London
Davis, T....... 1C Liverpool
Elderton, A. J. 2C London
Fabri, A....... 2C Sunderl'd
Freeman, W. .. 2C Greenock
Frith, H. R. .. 2C London
Lamont, B .... 1C Greenock
Lawrence, C. O. 2C Aberdeen
Love, J. ...... 2C N.Shields
McLeod, J. H. 1C Aberdeen
Mortimer, J. .. 2C Aberdeen
Owen, G H L. 1C Dover
Paterson, A. .. 2C Greenock
Ritchie, A. C... 1C Aberdeen
Roberts, R. B. 1C Bristol
Service, E. .... 2C Liverpool
Smith, H .. 1C Liverpool
Starkey, E. J .. 2C Liverpool
Tate, J R. .... 2C Liverpool
Thompson, J E. 1C Liverpool
Warnes, R..... 1C N Shields
Webster, R. .. 1C Hull
Wilson, W P. 1C Greenock
Young, A .... 2C N Shields

February 4th.

Angwin, W. E. 2C Falmouth
Arnott, D. C. .. 2C Glasgow
Blyth, R. ...... 1C Glasgow
Busby, J C. .. 2C Liverpool
Churchward, G. 2C Liverpool
Coombe, J .... 1C Leith
Dickie, J N. .. 2C Glasgow
Draper, A W. 2C N Shields
Drummond, A. 2C Liverpool
Evans, E T .. 1C N.Shields
Gibson, J A. .. 1C Leith
Grainger B .. 2C Leith
Gustavson, O. 1C London
Hall, R. ...... 2C Hull
Harrison, S. H 2C N.Shields
Hepburn, J .. 2C Leith
Herbert, T .... 1C Liverpool
Howard, J. A. 2C Belfast
Jarrett, A R... 1C Liverpool
Jenkins, W. H 1C Cardiff
Jones, T. B .... 1C Liverpool
Kane, T P W. 2C Liverpool
Kilner, R. R. .. 2C London
Laurie, T. .... 2C Glasgow
M Harg, G .... 2C Glasgow
M'Lean, G P. 1C Glasgow
M'Neill, W M 2C Glasgow
M'Nicol, J S .. 1C Glasgow
Mason, W .... 1C Cardiff
Maxwell, J N 1C Leith
Morris, T .... 2C Cardiff
Nuttall, R. .... 1C N Shields
Palmer, R. .... 1C Glasgow
Plussa, G. S .. 2C N Shields
Polden, A E .. 1C South'ton
Poole, R....... 1C Liverpool
Ray, W. H .. 1C Liverpool
Redman, C .. 2C Cardiff
Robinson, D G 2C N Shields
Ross, J T .... 2C Glasgow
Shepherd, H H. 2C Cardiff
Smith, D. .... 1C Leith
Steedman, F .. 1C Glasgow
Sutherland, W 1C Glasgow
Tait, C. B J .. 1C N Shields
Tee, E. A .... 1C South'ton
Walker, J K. .. 2C Leith
Wardle, H. W. 2C Liverpool
Watts, J R. .. 1C Liverpool
Wood, A....... 1C Leith

February 11th.

Ballantine, G...	2C	Greenock
Caizley, R.A O	1C	N Shields
Collings, F.....	1C	Liverpool
Cowle, E.	2C	Liverpool
Creach, J. D. ..	2C	Greenock
Creingan, S. R.	2C	Liverpool
Davies, T. H...	1C	Liverpool
Dugnid, J P. ..	2C	Greenock
Fadbury, R. B.	2C	London
Fawkes, R.	2C	N.Shields
Gentles, E. H.	2C	N.Shields
Gleig, S.	1C	Liverpool
Jones, J W. ..	2C	Liverpool
Jones, W H. ..	2C	Liverpool
Knight, J.	1C	Liverpool
Lawrie, J. B. ..	1C	London
Lewin, R T. ..	1C	Liverpool
Lunn, J. R.....	2C	N.Shields
Monoghan, B E.	1C	Liverpool
Monro, H. G...	2C	Greenock
Paynter, R. B.	2C	London
Robertson. S A	1C	Dundee
Shimmin, H. L	2C	Liverpool
Thornicroft,J.B.	2C	N.Shields
Wetherall, G E.	2C	N Shields

February 18th

Aitkenhead A.O.	2C	N Shields
Alison, G. D ..	2C	London
Anderson, H ..	2C	South'ton
Aiwood, E.T.G	2C	Cardiff
Balbirnie, R ..	1C	Liverpool
Bascombe, A S	2C	Plymouth
Bell, J	1C	Leith
Bell, W	1C	Glasgow
Bengtsson, E H	1C	W Hart'l
Bennett, H W	1C	Glasgow
Biggleston,H G	2C	Plymouth
Black, P. M. ..	2C	London
Boaden, E. J ..	1C	London
Board, O H ..	1C	South'ton
Buchanan, A. ..	1C	Barrow
Chivers, F. H	1C	Cardiff
Clark, R. F ..	1C	Leith
Clarke, W D ..	2C	N.Shields
Davies, A. C. ..	1C	Cardiff
Dunn, R. J.....	1C	London
Foxwell, C. H	2C	Cardiff
Gardner, G A.	2C	Glasgow
Gibbons, W. G.	1C	South'ton
Gow, F	1C	W. Hart'l
Grant, A. E. ...	1C	N.Shields
Gunn, K.	1C	Cardiff
Guthrie, D. G.	1C	Leith
Harrison, V. ..	1C	N.Shields
Hobbs, W. G.	2C	W Hart'l
Holbrook, C. F.	2C	W.Hart'l
Hossach, R. H	2C	London
Hudson, J. J ..	1C	N Shields
Innes, W. G. ..	2C	Leith
Ireland, J. F. ..	2C	Glasgow
Jones, H.......	1C	Liverpool
King, J.	2C	Glasgow
Kverndal, B. ..	2C	London
Lawler, E.	2C	Liverpool
Lumb, P H. ..	2C	W. Hart'l
Macmillan, J C.	2C	Greenock
M'Intyre, J ..	1C	London
M'Neil, R J. ..	1C	W. Hart'l
Medd. W.	2C	N.Shields
Melville, J S...	2C	Cardiff
Millard, W E.	1C	W Hart'l
Minto, B.... ..	1C	W Hart'l
Morrison, A. C	1C	South'ton
Morton, W T	1C	Barrow
Nicholls, J	2C	Plymouth
Nicol, W	1C	W. Hart'l
Olsen, H E. O	2C	Cardiff
Pate, D. B.	2C	Glasgow
Renwick, R. ..	2C	N Shields
Richardson,T R.	1C	Glasgow
Ritchie, H	2C	Glasgow.
Roberts, R. A	2C	Liverpool
Rosser, T E. ..	1C	Cardiff
Scales, W L...	2C	Liverpool
Stewart, A B ..	1C	Leith
Thomas, T.....	1C	Cardiff
Thomas, T. W	1C	Cardiff
Turnbull, W T	1C	Glasgow
Waites, J.	2C	W Hart'l
Williams, J L.	2C	Cardiff
Wilson, W	2C	Leith

"BURNETTIZINE" TIMBER PRESERVATIVE.—Last year several of the large steamship companies had the woodwork of their refrigerating installations preserved under pressure by "Burnettizine," including three ships of the Nelson Line, the Star Line and Shaw-Savill and Albion Line. Agents have been appointed in the principal shipbuilding centres.

SALVING OF THE DESTROYER "EDEN."—In connection with the salving of the destroyer *Eden* effective work was performed by the Merryweather portable salvage plant belonging to the Dover Harbour Board. As soon as the destroyer was brought into the harbour arrangements were made for the use of this plant to assist in keeping the water under. It was first of all fitted up on the quay and three 5-in. pipes were got to work in the stokeholds and engine rooms. Later on the pumps were lowered on to the torpedo boat, where they pumped out the water at full bore. The salvage plant referred to has been in satisfactory use for several years. It is kept on shore all ready for taking to the assistance of any waterlogged vessels. Its portability is a great feature, and permits of its being readily placed on a damaged vessel in cases where circumstances render such a course desirable. The capacity of the pumps is about 450 tons of water per hour. The Dover Harbour tug *Lady Crundall* also has Merryweather salvage plant on board, the pumping power of this being about 800 tons of water per hour. It was the apparatus on board the *Lady Crundall* which rendered such excellent service last June and July on the occasions of the salving of the cruiser *Sappho* and the New Zealand liner *Whakatane*.

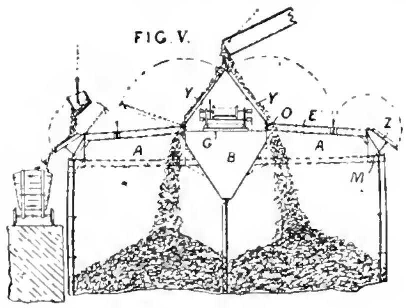
PORT OF LONDON AUTHORITY.—The possible increase in the dues which may be levied by the Port of London Authority on coasting steamers has led to considerable discussion by steamship owners and others whose trade is liable to be affected by any increase, and those who are interested in the coastal traffic are being exhorted to give special attention to the clauses of the Act which deal with this subject. The difference between the cost of carriage by land and water is considerable, and, in some cases, for certain classes of goods, constitutes a margin which alone admits of these being placed on the London market at prices to compete advantageously with goods manufactured at other centres of industry. Manifestly the London market reaps a great gain thereby, so also do the residents within easy reach of the area of this distributing centre. There are many well-known provincial manufactures which would be adversely affected by an increase in the dues, and when we bear in mind the advantages given to continental and over-sea manufacturers in respect to carriage of goods for our home markets, it behoves those who are responsible for the levying of dues to weigh carefully the whole of the questions involved. The cost of transit for farm and market-garden produce to the metropolitan markets is another branch of this same subject, which has long demanded the action of a strong committee, with a view to the establishment of a co-operative system under conditions calculated to minimize the expense to the individual grower, and obviously encourage a home industry at present labouring under many disadvantages, some of these at least being due to preventible causes.

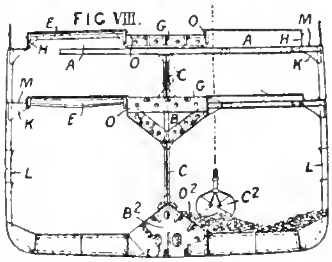
THE SOCIETY OF ENGINEERS (Society of Engineers, established 1854; Civil and Mechanical Engineers' Society, founded 1859; amalgamated January, 1910).—The first ordinary meeting of the new society, formed by the amalgamation of the Society of Engineers and the Civil and Mechanical Engineers' Society, was held on February 7th, 1910, at Caxton Hall, Westminster. At the commencement the meeting was presided over by Mr. E. J. Silcock, M.Inst. C.E., F.S.I., F.G.S., last president of the Society of Engineers, and Mr. W. Noble Twelvetrees, M.I.Mech.E., A.M.I.E.E., last president of the Civil and Mechanical Engineers' Society. Mr. Diogo A. Symons, M.Inst.C.E., M.I.Mech.E., the first president of the new society, later took the chair. Votes of thanks to the presidents of the constituent societies were proposed by the senior past presidents, and seconded by the senior vice-presidents of the Society of Engineers and of the Civil and Mechanical Engineers' Society. These resolutions were carried by acclamation, and the president then delivered his inaugural address. After rendering thanks for his election as first president of the new Society, Mr. Symons alluded to the internal affairs of the Society, pointing out that since the amalgamation there were over 700 members, and putting in a plea for large attendances at the meetings. Referring to the examination which was to be the qualification for Fellowship of the new Society, he believed that its introduction would have the same beneficial effect as had been the case in the Institution of Civil Engineers. Proceeding to more general subjects, he called attention to the value of workshop training to engineering students, whether they intended to take up the civil or the mechanical branch of the profession. He belonged to the civil branch, but had often looked back with gratitude to the time he had spent in the shops. Ferro-concrete, so largely used at the present had in many instances proved economical and entirely satisfactory for constructional works. He, however, considered that a large factor of safety should be allowed and every care taken to ensure the use of the very best materials and workmanship. Alluding to the subject of aviation, it was gratifying to note that British manufacturers and aeroplanists were making good headway, and that several aviation meetings were to be held in England during the present year. Speaking of the education of young engineers he emphasized the importance of a thorough grounding in fundamental principles before any attempt at specialization was attempted, and laid stress on the advantage of gaining engineering experience with a contractor on public works. The tendency of engineering students to accept salaried appointments, after too brief a training was deprecated because such appointments usually involved loss of valuable instruction and experience. In conclusion, a further reference was made to the details of the amalgamation which had just been effected. A vote of thanks was heartily accorded to the president for his address, and the proceedings then terminated.

The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs. E P Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W C

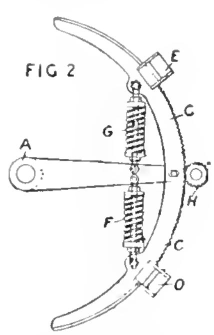
No. 20517. Cargo Vessels.—Relates to detailed improvements in self-trimming cargo vessels with side hatchways. The hatchways A, fig. 5, are wide and continuous and are unbroken by crossing winch platforms or similar structures. Between the inner walls O is fitted a raised platform G covering a tank B, the side walls of which are formed by downwardly extending the inner hatchway walls to meet below the level of the deck M. The tank B may also be placed partly above and partly below the lower deck level, as shown in Fig. 8, in which case the added space at the uppermost deck is in





free communication with the cargo space proper. The tank B is divided into compartments and is preferably supported by a row of stanchions C, while its boundaries, continuous throughout the length of the hold, may be extended through the propelling-machinery space. With the propelling-machinery aft, the platform G may extend under the bridge house. The side walls of the bridge are formed in line with the side hatchway walls; the poop and forecastle walls may be similarly arranged. Or the bridge house may be built at either side of the platform G, which would then be unobstructed from forecastle to poop. The hinged hatchway covers Y, Z, supported by webs E, are formed so that they can be swung back to form cargo shoots. The platform G may be fitted with rails, travelling and unloading mechanism, and

FIG 2

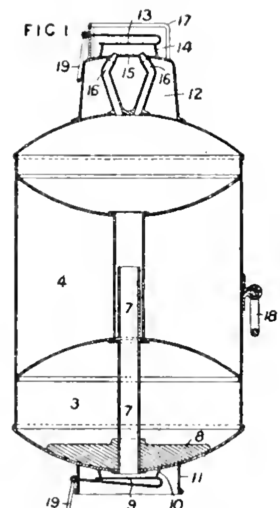


portable shoots. The deck beams may have removable sections for unloading timber. The central portion of the ordinary cellular double bottom B^2, or a separate compartment B^2 in conjunction with ordinary floors, is formed with sloping sides D^2 to facilitate the discharge of cargo by means of grabs C^2. The transverse frames L are connected with the deck M by plates knees K which extend inwardly to support the hatchway sides H.

No. 20532. Steering-gear.—The tiller A, fig. 2, is moved by means of a toothed rack C constrained to move in a path fixed by the guides D, E, which are fitted to or connected with the engine sole-plate. Springs F, G are utilized to connect the rack C to the tiller A, thereby taking up any shock. The rack C is operated by the pinion H on the engine shaft. By this construction, movement of the rudder-head in any direction is not conveyed to any part of the steering gear.

No. 20792.—Lifebuoy Lights. An acetylene light for use with life-buoys is constructed as shown in Fig. 1. The seals (9, 13) are protected from accidental damage by flanges or wire galleries (11, 17). When the life-buoy is thrown overboard, it carries the light with it by means of a line attached to a ring (18), and the seals (9, 13) which are fixed

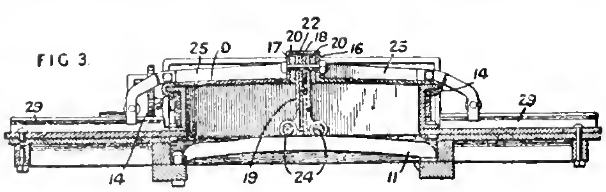
FIG I



to the supporting-rings (19) are ripped away from the rims (10, 14) to which they are soldered. The lights float upright owing to a weight (8) and float chamber (4). The water gains access through a tube (7) to a carbide chamber (3) and through gauze (15) to a calcium phosphide chamber (12). The acetylene that is generated ignites at the mouths of burners (16).

No. 22261. Hatches and Hatchways.—Hatchways D are made in sections which open outwards in opposite directions by means of a horizontal operating-screw with oppositely-threaded ends engaging screwed lugs carried by the sections. The hatchways sections are provided with ribs (25) which engage tracks (20) extending from opposite sides of the hatchway, vertical bars (10) carrying rollers which ride on the end

FIG 3.



beams being also provided within the hatchway for slidably supporting the sections. The rollers (24) move over the centrally-pivoted cross-bar (11), which is slightly arched to draw the flanges (14) upwardly against the flanges of the coaming. When the hatch sections are bolted together, the upwardly-turned flanges (16, 17) are covered by a strip (18) to form a water-tight joint. Filling and rubber strips (20, 22) are arranged on each side of the vertical plates (19).

The Marine Engineer

And Naval Architect.

LONDON, APRIL, 1910.

THE NAVY ESTIMATES

THE Navy Estimates for 1910-11 were issued on March 9th, with the usual explanatory memorandum. They show, as was expected, a very large increase, amounting in the aggregate to nearly $5\frac{1}{2}$ millions. The total sum asked for is a little over $40\frac{1}{2}$ millions. Only once before in our history have the Navy Estimates attained such a figure, but there can be no doubt that this huge expenditure is fully justified in the circumstances. The greater part of the increase is due to the large programme of construction which became necessary last year, when it was discovered that Germany had practically caught this country up in regard to rate of construction. The new programme of shipbuilding comprises five large armoured ships, five protected cruisers, twenty destroyers and ten submarines. There are, in addition, three destroyers for New Zealand, and a considerable number of those useful auxiliaries, without which no fleet in the present day is adequately equipped. There is also an increase in the *personnel*, made necessary by the increase in the number of ships. On the whole it will be admitted that these Estimates are fairly satisfactory, and that they are not insufficient nor excessive. They are framed, indeed, taking them all round, upon the expenditure and progress of other countries, and should maintain under ordinary conditions the two-Power standard, even if they do not give us the larger programme of two-keels-to-one.

The debate on the Estimates, which extended over the larger part of four days in the House of Commons, revealed, if it cannot be said general satisfaction, at least no general discontent, with the provision which the Government has considered essential. Mr. Arthur Lee, who was Civil Lord of the Admiralty in the last Unionist Administration, expressed the criticism which must have occurred to all naval students who have closely examined these Estimates. We refer, of course, to what appears to be an inadequate monetary provision for the ships of the new programme. There can scarcely be any doubt that if shipbuilding proceeds abroad at a greater rate than formerly, supplementary estimates will be required in the autumn for pushing on the construction of these vessels. It is only fair to the contractors that they should have ample notice in advance before the ships are to be laid down, now that the period for completion has been reduced to two years. The attention paid during the debate to the question of accelerated construction is an indication of the general feeling in the country upon this particular point.

It is not only in regard to the larger vessels, but, as Mr. Eyres-Monsell, a retired torpedo lieutenant, pointed out, the building of destroyers also needs quickening to compete with the rate which now obtains in Germany. There is no reason why we should not build as quickly here as there, but the completion of one or two destroyers is not to be taken as a criterion of the general rate of construction. Although there was some protest on the part of the Labour members, and those who follow Mr. Murray Macdonald, against the growth of the Estimates, a division on an amendment proposed by Mr. Lough was rejected, only thirty-four members voting for it. Many other subjects occupied the attention of the House during the debate. Mr. Falle, in an interesting speech, urged the claims of the engineers to be accorded executive rank. This is a subject to which more attention will be directed in the future. Short service in the Navy was also discussed, but Mr. McKenna was able to show that the system has its value in building up our reserves, and generally it must be admitted that the number of the *personnel* has been settled with due regard to war requirements.

THE BATTLESHIP OF THE FUTURE.

ONE of the most interesting papers, from a general standpoint, which was read at the meeting of the Institution of Naval Architects, is one contributed by Rear-Admiral R. H. S. Bacon, under the above title. The title itself would imply some large imaginative capacity or prophetic ability, but this is not intended by the author, his object being to review the chief features of battleship design and the direction of progress in modern naval conditions in order to promote discussion. The paper is an admirable treatise on the subject, and is so concise and closely reasoned as to make it a matter of difficulty to summarise it in any way without risk of losing some of its value. The proposition laid down was how to design a ship which will prove an adequate defence to oversea expeditions. It is pointed out that the battleship of to-day is not the predominant factor it used to be, owing to the multiplication of its enemies which include every vessel carrying a torpedo, cruisers, destroyers, submarines, and under certain conditions mine layers, consequently it is essentially for fighting other battleships and shuns other classes of vessels. The defencelessness of the battleship against torpedo attacks has changed to a certain extent the tactical and strategical use of such a ship. The author, therefore, treats the battleship solely from the point of view of being a gun platform. As to the relative merits of gun *versus* armour, it is clear that the advantage is with the gun, and the tendency is that in the future this feature is likely to increase rather than decrease. In summing up, the author

points out that all the considerations of offence and defence point to increase in size of battleships as modern gun construction advances. But since the modern battleship no longer holds the supreme position, which in the old days made the battleship the sole arbiter of sea power, it is improbable that, as the torpedo improves, battleships unable to defend themselves against any form of torpedo craft will be built merely to fight battleships. The functions of the large cruiser will, therefore, be assumed by the battleship, high speed will become more and more necessary, and armour protection will be less accentuated than at present. The link between the ocean-going destroyer and the battleship will become closer, and it is reasonable to expect that the large monsters of the future will always be accompanied by torpedo craft of high sea-going speed as defensive and offensive satellites. The conclusion arrived at by the author is that the battleship as now known will develop from a single ship into a battleship unit, comprising a large armoured cruiser with attendant torpedo craft. Under these circumstances the line of battle, as we now know it, will be radically modified, and the fleet action of the future will, in course of time, develop into an aggregation of duels between opposing battle units. If these surmises are realized the size of ships and power of guns will continue to increase until war, the great arbitrator among theories, will confirm or reconstitute our opinions regarding naval armaments. The paper did not succeed in raising the discussion that one would have anticipated, and the views of the Admiralty experts were not in evidence at all. However, the paper is one of the best of its kind ever written, and should form material for much earnest thought by those competent to grapple with the intricacies of the subject.

BRITTLENESS OF MILD STEEL.

The failure of mild steel plates during working operations in the workshop, or after use in the boiler, has given rise to much speculation as to its cause, and considerable effort has been made to arrive at a reliable conclusion on a sound basis. Towards this end experiments have been made by Mr. C. E. Stromeyer, and the results were communicated to the Institution of Naval Architects in a paper written by him on "The brittleness of mild steel, due to nitrogen." Although the paper was not actually read, it will form a useful addition to our stock of knowledge on the subject. The experiments were undertaken to ascertain whether any mechanical tests could be relied upon to discriminate between such plates as behave well, both when tested and subsequently, and such as behave well when tested, but fail either in the workshop or when put to use in a boiler. The first point sought by the author was whether any ageing effect was set up, and to avoid the expenditure of long periods of time, advantage was taken of the fact that boiling the sample for a few minutes at 212° Fahr. is the equivalent of prolonged waiting. Marked ageing effects were noticed in twenty-four out of twenty-six steels dealt with, one exception being a chrome vanadium steel and the other being exceptionally rich in sulphur. Samples containing much phosphorus did not seem to be as much affected by ageing and boiling as the other samples, and no marked difference could be detected between steels which failed in practice, and others of presumably good quality. Temper and cold bending tests, percussion tests, alternate bending tests and fatigue tests did not help to detect those steels which have failed in practice, nor did the ordinary chemical analysis help to elucidate matters, and it was only when the author, having heard of investigations made by Mr. Braune as to the effect of nitrogen on steel, had this element determined, that a light was thrown on the cause of most of the failures of plates collected by the author. The investigations have resulted in the following conclusions:—First, that the given percentage of phosphorus, plus five times the percentage of nitrogen, should not exceed 0·080 per cent.; and secondly, that no investigation into the failure of a mild steel plate can be considered complete unless both the phosphorus and nitrogen percentages have been determined. The tests of bad plates showed from three to five times the amount of nitrogen fixed above. A natural question arises as to when nitrogen gets into the steel? and, further, how can it be removed when it has got there? The most natural answer to the first question would be that it is introduced by contact of the molten metal with the air in the blast furnaces and in the Bessemer converter, and confirmation of this is given in the low nitrogen percentage in open hearth acid and basic steels and like products. The author thinks that, in spite of this confirmation, it has to be borne in mind that as yet it has not been possible to combine nitrogen with steel by merely heating the two together, and that the only means of effecting a combination is to heat steel in an atmosphere of ammonia. Now ammonia is not introduced into Bessemer converters, but it may be present in blast furnaces if the coking of the fuel has not entirely removed the nitrogen which is in the coal. Then also it seems as if the nitrogen, when once it has entered the pig-iron in the blast furnace, cannot be removed by subsequent heating. The suitable chemical for effecting this removal is believed to be titanium, but the addition of ferro-titanium alloy to steel has not demonstrated that this beneficial action takes place. It will be agreed that the investigation thus far is very important and interesting, and worthy of further development.

EXPERIMENTAL INVESTIGATIONS ON WAKE AND THRUST DEDUCTION VALVES.

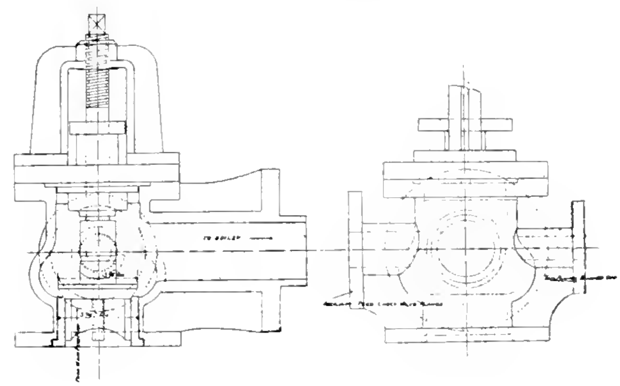
ANOTHER paper read before the Institute was by Mr. W. J. Luke (member of Council), in which experiments to the number of 2,000 are stated to have been carried out in the experimental tanks of Messrs. John Brown & Co.'s establishment at Clydebank. These experiments have been made with twin and single screws, and they deal with the runs of twin-screws in both directions of rotation. As a result it may be noted that the results obtained do not produce any evidence which will controvert the conclusions arrived at by Mr. Froude in 1886 and 1898, nor the conclusions of Professor McDermott, who utilized Mr. Froude's first published figures. Professor McDermott, in his paper submitted to the American Society of Naval Architects, has given the following statements for the wake of ships: w for single screws $= \cdot 16 \left(\frac{p}{m} L^{\frac{1}{6}} - \cdot 6\right)$, and w for twin-screws $= \cdot 13 \left(\frac{p}{m} L^{\frac{1}{6}} - 1 \cdot 1\right)$, p being the prismatic co-efficient, m the mid area co-efficient and L the length of the ship in feet. The scheme thus presented to Mr. Luke was to find by experiment the variation in wake and thrust deduction values, with (a) variation in speed, (b) variation in diameter and (c) variation in pitch ratio. These experiments were carried out both with a naked model and on a model with supporting bosses at an angle of $22\frac{1}{2}°$, with (a) variation in speed with constant diameter and constant pitch ratio, (b) variation in diameter with constant speed and constant pitch ratio, and (c) variation in pitch ratio with constant speed and constant diameter. It was necessary also to observe the effect on the hull efficiency elements due to change in the clearance of propellers from the hull, whether brought about by change of propeller position either longitudinally or transversely. A series of experiments was carried out as to varying diameters of a single screw with a fixed pitch ratio and fixed speed, and also the effect of bossing on the hull-efficiency. It was found generally in the examination of the (a) experiments, a variation in speed resulted in a decrease in wake friction with an increase in speed; but this is a generally accepted result. In the (b) experiments it would appear that such changes as appear are quite as much due to alterations in clearance as to alteration in diameter. In the (c) experiments little or no effect is produced by variations in either of the hull-efficiency elements; a slightly increasing wake is associated with a slightly increasing thrust deduction when the pitch is increased.

MESSRS. CLARKE, CHAPMAN & CO., LTD., have opened an office at 20, Queen Anne's Chambers, Broadway, Westminster, specially for the sale of their Water Tube Boilers (Woodeson's Patent), both for land and marine installations.

MARINE BOILER EXPLOSIONS.

From the Board of Trade Reports.

REPORT No. 1895 deals with the explosion from a feed-water check-valve chest on board the *Heathfield*. The explosion occurred on the 30th October, 1909, the vessel being in the North Channel, in the vicinity of Portpatrick, and proceeding to Alexandria. John Crawford, second engineer, and John Borrowman, third engineer, were severely scalded. The chest is what may be termed a $2\frac{1}{2}$ inches diameter feed check-valve chest, and is made throughout of brass. It was fastened to the boiler with six studs, $\frac{3}{4}$ inch in diameter. The flange to which the main feed pipe was fastened was 7 inches in diameter, and was secured to the pipe by five $\frac{5}{8}$-inch diameter bolts. A sleeve seat, with a suitable valve, capable of being put in its place without disturbing the cover of the valve chest, was also fitted. The greatest diameter of the valve was $3\frac{3}{8}$ inches, and that of the sleeve $3\frac{7}{16}$ inches at the place shown on the Plate. The explosion was of a serious nature. The feed



pipe had been slackened off for the purpose of making a new joint at the flange of the chest, when without any warning the sleeve seat and valve were blown out, allowing the contents of the boiler to the level of the valve to escape into the engine-room. The explosion was due to the defective and dangerous design of the independent valve seat of the chest in question. The observations of the Engineer Surveyor-in-Chief are as follows:—Had the valve seat been fitted in the customary manner, there would have been little risk in disconnecting the adjacent pipe, and it was only natural that the engineers in the vessel should have assumed the valve chest to be of the usual type. The casualty must therefore be considered to have been primarily due to the defective design of the chest in question, the dangerous nature of which was not suspected by those responsible for the safe working of the boilers.

Report No. 1898 deals with the explosion from a main steam pipe on board the s.s. *Orange Branch*. The explosion occurred on the 22nd September last, when the vessel was lying at Aden. No person was injured by the explosion. The pipe was made from a solid-drawn copper tube, 5 inches in internal diameter, No. 1, S.W.G. in thickness, and about 9 feet in length. The pipe cracked, circumferentially, for a length of 3 inches, at the neck of the flange, at the underside, next to the stop valve on the port boiler. The steam pressure at the time was 175 lbs. per square inch. The explosion was due to the material being unable to withstand the stresses set up by the expansion of the pipe, and the movement of the machinery. The observations of the Engineer Surveyor-in-Chief are as follows:—The explosion in this case was, fortunately, not of a serious nature. Although the pipe was not of a very suitable form for withstanding the stresses to which it might be subjected under ordinary working conditions, it appears to have remained intact for a considerable number of years; and its ultimate failure was, no doubt, primarily due to the loose engine seating, which had become so defective as to necessitate the removal of the engines in order to effect a satisfactory repair.

Metallic Cement, "Cracko."—In dealing with castings, defects of a minor description often become evident, which in no way interfere with the integrity of the casting for the purpose for which it is to be used, but render its appearance unsightly, and the stopping or plugging up of such defects removes the unsightly appearance and renders useful that which might otherwise have no value beyond that of scrap. We recently had brought to our notice a new form of metallic cement which, it is claimed, forms an important discovery in the process of repairing steel, iron, copper and lead work, for filling up blow holes in castings and in many other applications which come under the notice of engineers, founders and metal workers of every description. This cement is sold in the form of a powder, which only requires to be mixed with water so as to form a paste. When so formed it can be poured or pressed into the hole, crack or other part to be filled up, where it dries hard and becomes as a metal and then can be hammered, filed, drilled, turned and polished in the ordinary way. It is claimed that when perfectly dry it will stand water, fire, steam, air or oil at any pressure and is, therefore, applicable for stopping leaks in boilers, pipes, superheaters, tanks and pumps, and if it fulfils such a claim there is no doubt that it will save its cost many times over on a single job. We understand that it is better than lead for a spigot joint and can often be used where lead is not applicable. It is especially useful for use in tanks, boilers pipes, filters and pumps, as it has the same co-efficiency of expansion under heat as the metal of which the former are constructed, and thus the stopping does not drop out of the holes. In the case of porosity of structure in cylinders this can be entirely filled up, and when the cement is put under a patch on a boiler and the surplus cement squeezed out, an existent leak is cured in just the same way as if the plate was welded on. In the mechanical engineers' shop the cement can be used generally to stop up cracks and flaws, and to fill up counter-sunk screw and bolt holes perfectly level and smooth, and to make up any awkward corners and angles. We understand that pieces which have been broken off a casting can be replaced in such a way that the junction of the new material to the old material is practically unnoticeable. It gives a hard, smooth face and often saves filing so that the work can be allowed to take the paint at once. The cement is put on the market under the name of "Cracko" by the Bessemer Steel Cement Company, of 20, Little Britain, London, E.C.

"MIRAMAR."—Messrs. James Pollock, Sons & Co., Ltd., have recently shipped this new steel screw launch tug to South America for service on the great rivers. She has a length of 60 ft., breadth of 11 ft. 9 in., and depth 5 ft. 10 in., and is fitted with surface-condensing engines and return tube marine boiler, which gives her a speed of nearly eleven miles. The official trial trip took place recently during a sou'-westerly gale and a heavy sea, and the vessel acquitted herself quite creditably in the rough water, although she has been built for river service. For the comfort of the Officials, who will use this boat, a handsome teak deck-house has been fitted forward and special teak lavatory and bathroom accommodation aft.

MUNICIPAL HEALTH EXHIBITION.—This Exhibition, which is to be held in the Agricultural Hall, Islington, from May 7th to 14th, appears to be shaping well towards a successful issue. While the scope and intention of the promoters of the Exhibition lies more in the direction of municipal than of marine engineering, there is a considerable number of exhibits arranged for, which appeal to all engineers—especially if they be ratepayers and householders. We had an opportunity of visiting the former Exhibition held under similar auspices in 1908, and were interested and edified. Municipal matters and undertakings have progressed and improvements—with facilities for spending money *wisely*—have been effected meantime, so that the forthcoming Exhibition should, as it promises to be, an advance on its predecessor in indicating new methods, economies and improvements in connection with municipal undertakings for the benefit and health of the people and the public weal. By a close study of the exhibits and attention to such exhibitions, the visitor gains a knowledge of a science which will guide him in seeing how the ratepayers' and householders' money can be wisely and economically expended to gain the desired results.

THE NEW MOTHER-SHIP "BELLONA."

THE *Bellona* and her sister ship the *Boadicea* are the first two ships of the enlarged "Scout" type to be completed for service as "Mother-ships" to the destroyer flotillas. Two more, the *Blanche* and *Blonde*, are building at Pembroke Dockyard, and from all accounts the design is to be perpetuated in those ships of the 1910-1911 programme which are to be allotted to the Western dockyard.

Although they are undoubtedly superior vessels to the rather unsatisfactory "Scouts," the *Bellonas* are far from being ideal with respect to the work which they will be called upon to do; indeed, it is a source of wonder that ships of the enlarged *Bristol* type were not laid down in place of the *Blanche* and *Blonde*, considering the immense advance these "Town" class are upon the smaller preceding *Bellonas*. Some idea of the three types may be gathered from the particulars in Table A.

In the first place, the *Bellona* is much under-gunned, which defect, incidentally, will be remedied in her later sisters, as these are to carry ten 4-in. guns. Secondly, the *Bellona* has proved herself incapable of maintaining her speed during an eight hours' trial. Designed for 25 knots, she exceeded 27 knots on a short sprint, but owing to insufficient boiler installation the supply of steam sufficient to maintain 25 knots could not be kept up, and consequently her average on full speed trials worked out at 22 knots only. This inability to steam continuously at anything like a high speed is, of course, a defect which will greatly militate against her effectiveness in war, and although it is proposed to make certain alterations in the internal arrangements of the newer ships to remedy this, it is feared that their small dimensions preclude much hope of success. The *Bellona* is such a shell full of machinery that the "foot-plate" space in the engine rooms has had to be reduced to an impracticable minimum, there being scarcely sufficient room in them for the engineers to attend to their duties. The *Bellona* has 6 in. more beam and displaces 60 tons more than the *Boadicea*, but to what extent the later ships will improve upon these figures is unknown.

The *Bellona* was laid down on June 15th, 1908, and launched March 20th, 1909, being now in service as parent ship to the destroyers of the Nore Division. She is 385 ft. long, 41 ft. 6 in. beam and displaces 3360 tons at 13 ft. 6 in. draught. In general construction she closely follows the regular principles of modern warship design, having double bottoms under the machinery spaces and magazines, the inter-spaces being utilized for oil fuel and reserve feed-water tanks. There are three boiler-rooms and two engine-rooms, in continuous order, separated by water-tight athwartship bulkheads without doorways.

There are two decks and a 100-foot forecastle, the officers' cabins being forward on the main deck, the mess places and quarters for the crew aft, while the space amidships over the machinery rooms is filled by coal bunkers along each side and the usual ventilators, uptakes, fan rooms and communication passages in the middle section.

The outer bottom and topside plating is from ¾ in. to 1 in. in thickness, the thickest plates being in and near the keel amidships. Centrally the lower deck is flat, sloping downwards towards the sides, forming a protective arch over the vitals below. The upper deck is of high tensile steel plating, 1 in. thick over the area of the machinery and boilers. As may be seen from our illustration, the *Bellona* greatly resembles the *Adventure* Scouts, except that she has a main mast; this, however, will disappear in the *Blanche* and *Blonde*, which are to carry a single mast forward.

The 4-in. guns forward have been mounted on to a raised portion above the forecastle level in order to keep them as much as possible out of the seas which flood the fore parts when the ship is steaming at full speed. One of the great drawbacks to all small craft, from destroyers upwards to cruisers like the *Gem* class, is the way in which they all drive the seas over their forecastles when steaming fast in a seaway; the *Bellona* and *Boadicea* are no exceptions to the rule, and it is asserted that it would have been quite impossible to work the guns of the former when running over 25 knots on trials, as she shipped the "green" right up to her bridge. Whether this be so or not, the question naturally arises as to

the advisability of continuing the construction of these 3300-ton Scouts, which are lightly armed and cannot keep their speeds at sea, especially when such good all-round cruisers as the "Town" class can be built on 4800 tons. The crux of the matter is whether a distinct line is going to be drawn between the protected cruiser and the "Scout" mother-ship, or whether they will ultimately merge into a common type possessing the good qualities of each.

If both classes are to be perpetuated, then by all means the introduction of the smaller and slower "Acorns." But the requirements of the fleet only demand a relatively small number of "Scouts," when the cost would not be so overwhelming, and thus we might fix a limit of £300,000 or less for such craft, for which an eminently satisfactory type could be evolved. On the other hand, the protected cruiser would be developed along other lines, the question of which we will leave until dealing with the *Bristol* class.

In the table marked B the *Bellona* is compared with con-

TABLE A.

	Launched.	Displacement.	I.H.P.	Speed. Designed.	Speed. Highest.	Armament.	Coal.
Adventure	1904	2,940	16,000	25	26 25	10 3", 8 smaller, 2 T T	150/400 tons
Bellona	1909	3,360	18,000	25	27 9(?)	6 4", 8 ,, 3 T T	450/600 ,,
Bristol	1910	4,800	22,000	25	—	2 6", 10 4", 3 T.T.	Very large

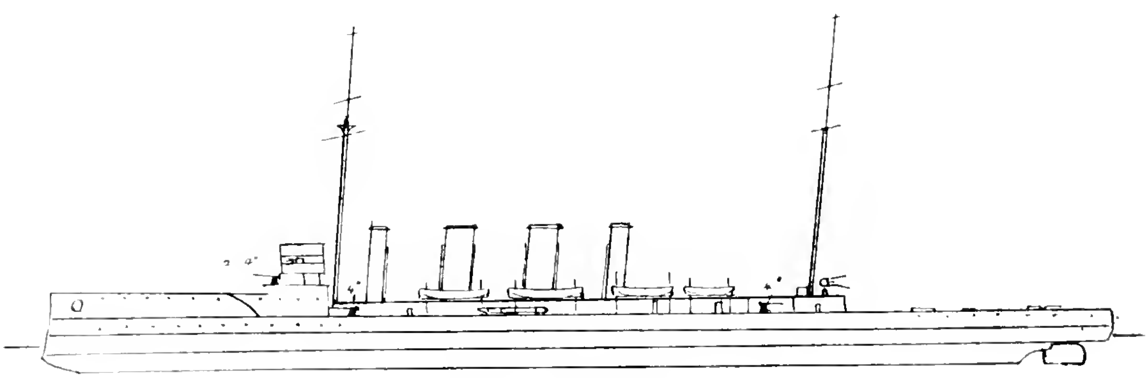
TABLE B.

Nation.	Class.	No. in Class.	Displacement.	I.H.P.	Speed	Armament.	Torpedo Tubes.	Coal Capacity.	Launched
Gt. Britain	*Bellona* ..	4	3,360	18,000	25/27·9	6 4", 8 smaller	3	450/600	1909
Japan ..	*Tone* ..	1	4,035	15,000	23	2 6", 10 4 7", 2 3"	3	750/1,000	1907
U S A. ..	*Salem* ..	3	3,750	16,000	24/26·8	2 5", 8 3"	2	475/1,250	1907
Russia ..	*Jemtchug* ..	1	3,106	17,000	24	8 4 7", 11 smaller	3	510/600	1902
Germany	*Augsburg* ..	4	4,281	20,000	25·5 [1]	12 4 1", 12 smaller	2	450/900	1909
Brazil ..	*Bahia* ..	2	3,000	18,000	26·5	10 4·7", 6 smaller	2	650/(?)	1908

[1] Previous ships of class have exceeded 28 knots.

let us have "Scouts" with high speed and good coal supply, even at the expense of armament, and protected cruisers strong enough and fast enough to sink such ships as the German *Dresden* and *Emden* classes. The "Towns" and improved "Towns" fill the requirements of the latter, but the *Bellonas* are far from being a satisfactory reply to the first postulate. Remembering that the destroyer *Swift* displaces 1800 tons, carries four 4-in. guns, can steam at 36 knots and cost £250,000 (a figure that could be greatly reduced if a number were to be built), the *Bellonas* make a poor show with their six 4-in. guns and 25 knots, although being nearly double her displacement they seem relatively cheaper for their £280,000. The happy mean seems to lie in a type a little slower than the *Swift*, bigger than the *Bellona* and carrying an armament of say, ten 4-in. guns—or whatever proves sufficient to deal with contemporary destroyers. As a destroyer the *Swift* is not a success, inasmuch as £250,000 apiece for such craft quite precludes any multiplication of the type, and numbers of destroyers we must have, hence

temporary foreign scouts, from which it may be seen that in almost every instance she comes out the worse for comparison. Alongside the *Bahia* and *Salem* her inferiority in coal supply and armament are very pronounced—indeed, the *Bahia* possesses nearly all the attributes of the ideal scout of the present day, upon a tonnage less by 600 tons than that of the British ship.



Plan of H M S *Bellona*

THE INSTITUTION OF CIVIL ENGINEERS. At the ordinary meeting, Tuesday, 5th April, at 8 p m , the papers to be read are the following "The New Clyde Bridge of the Caledonian Railway at Glasgow," by Donald Alexander Matheson, M.Inst C E. "The Queen Alexandra Bridge over the River Wear, Sunderland," by Francis Charles Buscarlet, Assoc M Inst C E., and Adam Hunter, M Inst C E At the students' meeting, Friday, 8th April, at 8 p m , a paper on "The Reconstruction and Extension of Egremont Ferry Pier" by G H Hodgson and H M Gell, Studs Inst C E , will be read

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

Activity in the Canadian Trade.

The New Atlantic service of the Canadian Northern Railway Company seems to be rapidly completing the details which are involved in the preparation for the inauguration of its line between this country and Canada. That its western terminus would be Montreal, with a call at Quebec during the open season of navigation, has long been realized. But to the last there was doubt as to the favoured port in British waters. Southampton—proud of its various adherents—felt safe as a competitor. But to its surprise and chagrin it has not won the prize. Bristol is to be the British terminus, and so once again the Great Western Railway scores. There is a rumour that certain of the older lines with which the Canadian Northern steamers will be in rivalry will try to make a counter move by calling at Fishguard *en route* for Liverpool, and there again the same railway company would reap the advantage.

But for us at the moment the sea development of the new service is enough. The managers of the new steamships have announced that their line is to be known as the "Royal Line." Accordingly the three steamers which are to maintain its ocean service have been re-named. The *Cairo*—formerly of the Egyptian Mail Line—is to be known as the *Royal Edward*, whilst her sister, the *Heliopolis*, is given the name of *Royal George*. These two ships are, of course, turbine-engined and most speedy and luxurious. There is, however, a third, which is after all not much inferior to them. This is the *Royal Sovereign*—a vessel built as recently as the year 1906 for the Italian General Navigation Company. Her former name was *Volturno*. Like the two first-named ships she was built on the Clyde by the Fairfield company, but her engines are of the reciprocating type driving twin screws. The initial sailing is to be made at the beginning of May, and it is expected that departures will be maintained at intervals of about ten days.

The boom in things Canadian meanwhile continues. The Grand Trunk Pacific Railway has had its second twin-screw, the *Prince George*—sister to *Prince Rupert* launched last year—put into the water by Messrs. Swan, Hunter & Wigham Richardson, whilst the Canadian Pacific has admitted that it is the motive power in the New Zealand Steamship Company—a Company which must not, of course, be confounded, as one important shipping daily has done, with the old-established New Zealand Shipping Company. This new line is to commence work on the 15th May, when it will despatch the steamship *Rakaia* from Montreal for New Zealand and Australian ports. The service is to be continued monthly, the *Whakatane* being appointed to follow the *Rakaia* in mid-June. In the trade from Liverpool it is said that the *Empress of Ireland*, sailing on the 11th March, took out absolutely full complements of passengers in both the second and third classes, whilst the Allan line is sending its steamers *Grampian* and *Hesperian* to St. John, New Brunswick, on the 24th March and 3rd April respectively.

The Union Castle Line

has appointed its new mail and passenger steamship *Balmoral Castle*, of 13,000 tons, just completing at Fairfield, to take the sailing of 2nd April. This steamer is that which has been honoured by being selected to take the Prince and Princess of Wales on their historic visit to South Africa to open the new Dominion Parliament at the end of August. On that occasion the vessel will be commissioned as a King's ship, and the Prince will hoist his flag aboard her as an Admiral. She will be accompanied by a cruiser as escort. Before she is taken off her station to prepare for this memorable trip the *Balmoral Castle* will have completed a second round voyage to South Africa, and thus given travellers some opportunity of seeing something of the comfort and luxury which can nowadays be offered by the Union Castle Line. The *Balmoral Castle* will, of course, be something like twice the size of the Orient line steamship *Ophir*, the mail steamer in which the Royal couple made their voyage to Australia when they went to perform a similar function for the Commonwealth Parliament.

Wireless Telegraphy

seems to be making rapid headway. Stations are being opened in the Far East, Australia and South Africa, and more and more liners are being fitted with installations. P. & O. have just given an order for the equipment of their mail steamers *Macedonia*, *Moldavia* and *Arabia*, whilst of Combine ships a large number have been added to the list. These belong to four Companies—the Atlantic Transport, the Leyland line, the Red Star line, and the White Star line. Of the latter fleet the convenience is to be given to vessels employed in the Australian and New Zealand trades, as well as to those on the Atlantic service. The value of wireless is already fully established, but two recent incidents have shown its value. First of these was when the Royal Mail steamer *Tagus* flashed the news of her collision with the sailing vessel *Republic*, and so gave opportunity to send assistance in case it should be needed. The other was a message sent by the Anchor express steamer *Caledonia*, which reported from the Atlantic to the station at Cape Race the fact that she had safe on board the crew—some forty-eight persons—of the Russian steamship *Korea*, which, having encountered extremely bad weather, had been abandoned in what was believed to be a sinking state. Unfortunately, however, the big Russian remained afloat long enough to cause trouble. For, lying a thousand miles west of Tory Island in the track of vessels bound for North of Ireland and Scottish ports, she was run into at night by the Allan liner *Ionian*, and caused that vessel considerable damage, though fortunately enough there were no injuries below the water line.

The latest suggestion for the extension of wireless is that it can usefully be added to the equipment of steam trawlers, and if that suggestion be adopted, here is indeed a wide field for the Company to open up. It is evident that it may be of great value to the owners of such vessels, which bring in cargoes of so perishable a nature as fish, to have timely notice of their anticipated arrival and to have full details of the amount and quality of the catch of which they have to dispose.

An ancient Steamship.

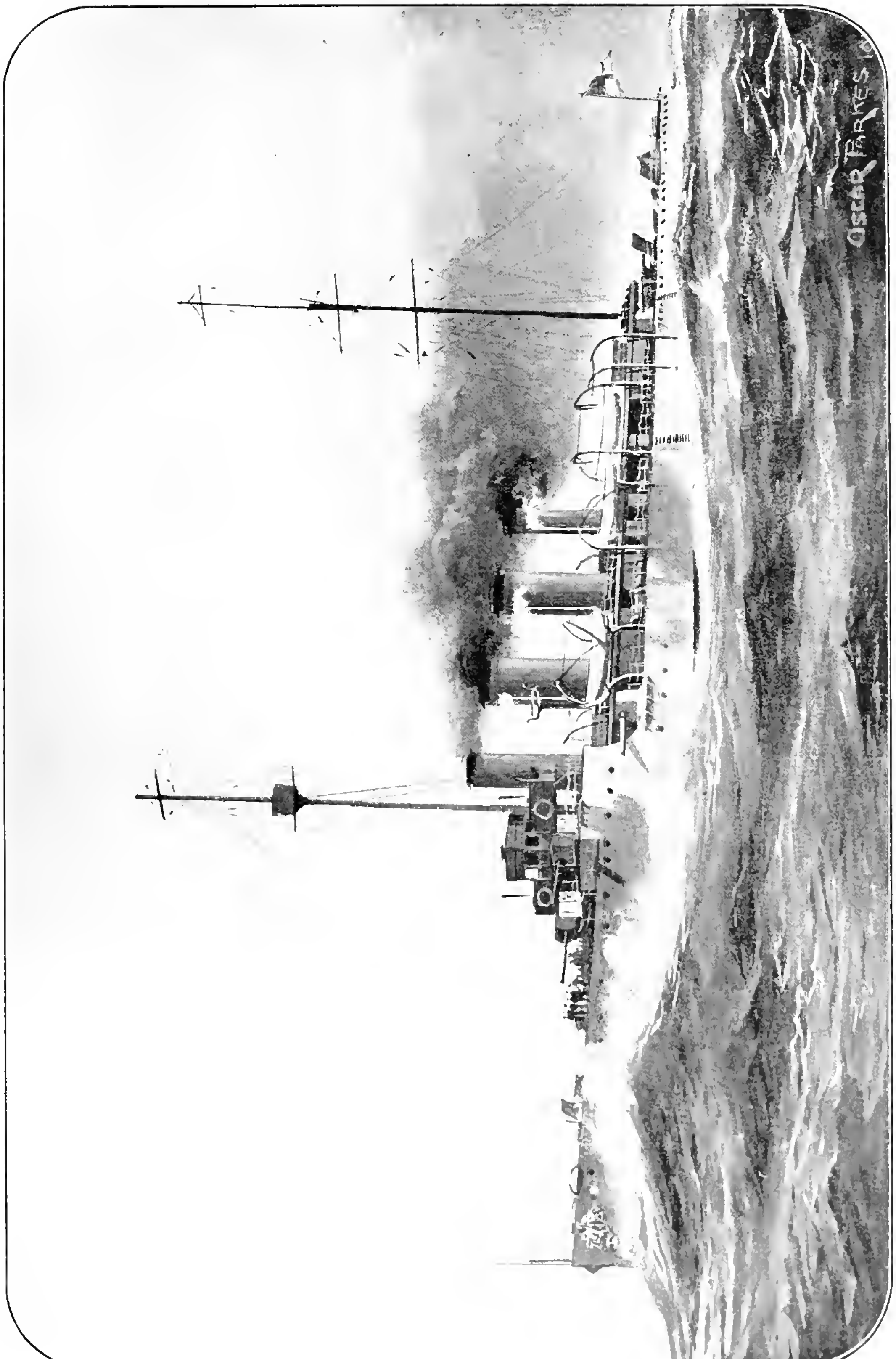
Amongst the many old vessels which have recently gone to the scrap heap may be noted the *Lara* of the Waterford Steamship Company. She was built as long ago as the year 1868, and was launched at Waterford, a seaport which in these days is not widely known as a shipbuilding centre. She is beached and will be dispersed in the upper waters of the River Mersey.

The famous Union Castle Liner,

the *Dunnottar Castle*, has been definitely sold out of the fleet. Though only built as recently as the year 1890 it is a long time since she took a sailing in the mail service, for after lying up off Netley for a considerable time as a reserve ship, she went out to New York under charter to the New York and Panama Company. On her return Dr. H. S. Lunn, of Co-operative Cruising fame, who had just lost his public yacht through an unfortunate collision in the Channel, took her on charter. Since that time she seems to have been fully occupied, and has evidently given such satisfaction to those concerned that they have come to the conclusion that they would be well advised to purchase her outright.

The "Ellan Vannin."

The Board of Trade inquiry held at Liverpool for the purpose of investigating the circumstances surrounding the loss of the Isle of Man steamship *Ellan Vannin* with all hands at the mouth of the Mersey on the morning of the 3rd December, took three full days to record the evidence tendered to it and to hear the speeches of Counsel. It has since considered and delivered its judgment. The facts concerning the actual loss are shrouded in mystery, although the exact time of the disaster is settled by more than one piece of evidence. Various theories as to the cause of the wreck were advanced. First there was the suggestion of collision with another steamer. But two obstacles were in the way of the acceptation of this suggestion. First there was no steamer missing or damaged which could have been in contact with her, and secondly, the nature of the damage did not suggest that such a collision had occurred. Next there was the admitted fact that a lighted buoy Q1 had broken adrift in that awful hurricane, and it was thought that it might



H.M.S. "Bellona." See page 330

have been that the ill-fated ship struck this. But the buoy showed no sign of collision-damage, and its light, which would certainly have been put out by a collision, was still burning when it was found. Moreover it was clearly shown that the steamer could never have been near the buoy's original station to have come in contact with its cable, nor was she ever near the course of its drift to touch it when the chain had parted. The evidence of the master of the Belfast steamer *Heroic*, inward bound at the same time as the *Ellan Vannin*, suggested the truth about the matter. There was a heavy following sea on at the mouth of the river, and the tendency in a steamer was to broach to and ship the full force of the waves. The *Heroic*—a larger and more powerful vessel—evidently gave her master a bad quarter of an hour. But she pulled through all right. Not so the poor little Isle of Man boat. She took a sea which smashed in her saloon skylight and flooded her aft. There was a hurried rush of passengers to the deck, and a determined attempt to get out the boats. Hence, too, the explanation of the fact that passengers' bodies were not found in the saloon and the further fact that the davits were swung outwards. A forlorn hope to launch boats into that raging sea, but there was nothing else to be done. The vessel was rapidly going down by the stern—so rapidly that her after end was found sunk 13 ft. in the sand. Her bows remained afloat, and being struck underneath by the big seas were so damaged that they were broken off before they too sank under the waves. The accident seems to have been one which was assuredly the act of God, for no one can be blamed for what happened, though possibly the master might have been better advised if he had stood out to sea till the weather moderated. But it is easy to be wise after the event, and the weather was probably more severe than either master or ship had ever experienced in all the long years that they had traversed the Irish Sea.

The Ostend Route.

On the 7th March the new turbine-engined mail steamship *Pieter de Coninck*, the second of the two sisters now under construction for the Belgian State Railways, was launched from the yard of the Société Cockerill at Hoboken, near Antwerp. The former of the pair was the *Jan Breydel*. These vessels are improved steamers of the type of the *Princesse Elizabeth*, which has during the last year or two made such a reputation for herself on the Dover and Ostend service.

The National Steamship Company

has published its accounts for the year 1909 and has held its annual meeting. The position is not altogether a hopeful one. The original capital of £875,000 has long ago been written down to £225,000, and the year under review commenced with an adverse balance on trading of about £118,000. It closes with an increase of this balance on the wrong side of the account, the total now being no less than £133,000. As Mr. Holland Clark remarked at the annual meeting the position is almost Gilbertian. "When," he asked, "is it going to stop?" and, "What is the good of going on?" "Why not sell the business and get what can be got out of the proceeds?" The chairman seemed to sympathise thoroughly with the views which this gentleman expressed, but he explained that the Board were powerless to take any action, as influential shareholders blocked the way and refused to consider suggestions for either winding up or reconstruction. Since the meeting I observe one satisfactory piece of news regarding the Company. Their steamship *Manhattan* is engaged to sail from Liverpool in the cargo service of the White Star line, and she will doubtless make a profit on this voyage. Possibly she may be continued in the White Star service. But though this is satisfactory as far as it goes, the *Manhattan* can hardly manage to work off the mountain of past losses which have accumulated in the years that are gone.

A Protracted Launch.—The launch in March for the Glasgow Corporation of the large hopper steamer, built by Messrs. Beardmore, proved a somewhat tedious process. An early morning frost affected the lubricant on the launching ways to such an extent that the vessel took about an hour and a half to reach a water-borne position in the river. The disinclination to move off the ways was combated by jacks and other pushing measures.

MOTOR BOAT EXHIBITION.

The regret we experienced at the Motor Exhibition some months ago that there were no boats on view has been entirely dissipated by the show at Olympia in March, which was good on the whole and satisfactory to the visitor. It should also have a lasting effect upon the circle of customers—a consummation desired by the exhibitors and promoters as one of the substantial good things arising from the show to justify the labour and expense involved. There were several firms of repute in motor-boat building conspicuous by absence from the list of stall-holders, and it may be that they are reserving themselves for the exhibition at Olympia in September, when possibly Mr. Bridges and his committee may secure their co-operation at the Naval and Mercantile Marine Engineering Exhibition. So closely are the steam and internal combustion engineers approximating in respect to their work and practice that it appears desirable to have both well represented under the same roof. The spirit of the air has been moving around us so prominently of recent years that it was fitting to have a goodly display of airships and machinery specially suitable for such. Vessels for the navigation of the air, as well as those for the navigation of the water, were both well in evidence to show what has been and is being done to cater for the wants and nec ssities of the age. The weight of material required to develop horse power has been reduced year by year, and one is inclined to think to its lowest factor. The experimental tests and mixings of metals to find a combination which will give the maximum of strength with the minimum of weight has brought about this result, but the factor of safety must be considered, and when it is borne in mind that even tested material has shown strange vagaries at times and failed at a critical moment, the advice of "ca' canny" is worth considering, as well from the manufacturer's point of view as from that of the purchaser, and the lighter the element which forms the medium on which the structure rests, the more important becomes this factor. Among the many exhibits it is difficult to refer to only a few, where all are full of interest and each in some point of detail, as, with all their sameness, there are differences and improvements which have been due to the varied experiences of makers and their customers; these experiences are of historical interest to every firm and deserve special attention. Messrs. Thornycroft's exhibits consisted of internal combustion engines either for paraffin or petrol; a strong sea-going launch of an attractive design, well built and serviceable, with all the necessary equipment around for the requirements of marine propulsion in several different sizes, pumping and lighting sets with motor drive, an assortment of bronze propellers, complete and finished smooth and clean with diameters and pitches to suit different sizes and speeds for launches and motor boats. The sizes of the motors varied from about 7½ brake horse-power to 56 b.h.p. This firm has built engines (paraffin and petrol) up to 350 b.h.p. The Thornycroft system of using paraffin exclusively is by having one lamp only for heating the vapourizer, no matter how many cylinders may be fitted in the engine; and the exhibit also showed the arrangement by which after running on petrol for a few minutes to heat the vapourizer, paraffin may be turned on and used without the lamp. The ignition in all the types is by high-tension magnets, as it has been found to be more satisfactory for marine work, rendering starting easier and more reliable, while it also avoids the complication of a duplicate ignition coil and battery. The lubricating arrangement has been improved and, as pointed out, is simple and of good design. The control of the engines is claimed to be excellent; many motor launches of the type exhibited, about 30 ft. in length, —have been built for the merchant service and the pilot and custom's services. The Ailsa Craig Motor Co., Chiswick, had also a capital set of exhibits, from a single cylinder motor of 4 h.p., with reversing propeller, to a 6-cylinder motor of 50 h.p., with reversing gear and solid propeller. Considerable interest is attached to a 2-cylinder 8-h.p. motor specially arranged for use with the Ailsa Craig patent auxiliary device for small yachts. A beautiful model of a sailing yacht fitted with this device was also on view, and a working model showing the cylinders and general arrangement of the Ailsa

Craig marine motors. In addition there were the various details pertaining to the motors and boat equipment and model of a fishing boat the *Ailsa Craig*, specially built to show the great advantage of such a vessel for the fishing industry. It is now at work off the Cornish coast and doing good work in proving the case of the motor *versus* sails. The manufactures of Messrs. Brooke & Co., Lowestoft, were well displayed, the 2-cylinder Brooke motor, specially designed to fulfil the British Motor Boat Club's one design class, being built up to the limit with two cylinders of 4 in. bore and 6 in. stroke, developing 24 h.p., claimed special attention, as also did the motor boats for racing purposes and general use. A Brooke motor with six cylinders of 65 h.p. was a special exhibit. As a set-off to the collection of excellent exhibits there was displayed a large assortment of medals and cups won by the "Brooke" engines—a proof of the success which has attended the designing and building, with careful attention to the details of the engines, by this firm. Besides the exhibits of marine motors and boats—which latter included the fast cruising launch *Tyreless*—30 ft. long, designed by Messrs. Cox & King, and built of mahogany, with a 40-h.p. six-cylinder Brooke marine motor and capable of a speed of 18 knots, the property of F. Gordon Platt, Esq.—there was a motor set coupled to a centrifugal pump for salvage work, and another coupled to a dynamo for lighting purposes ashore or afloat.

The hydroplane was not so largely represented as one would have expected, the Auxiliary Power Co. had one on view, however, and there were many exhibits which gave pleasure and satisfaction to the visitor, who, therefore, looks forward to the next Exhibition with an appetite not satiated but whetted for the display.

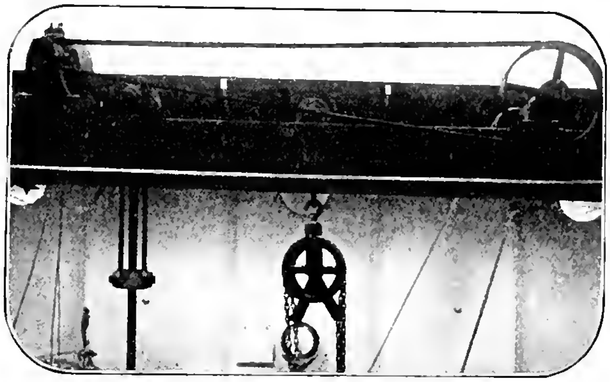
DERMATINE VALVES.

It will be of interest to all marine engineers to know that the Dermatine Co., the well-known makers of valves for air and circulating pumps, have adapted the Patent Anchor Bush to their valves, so that one type of Anchor Bush can be used with either flexible or hard valves.

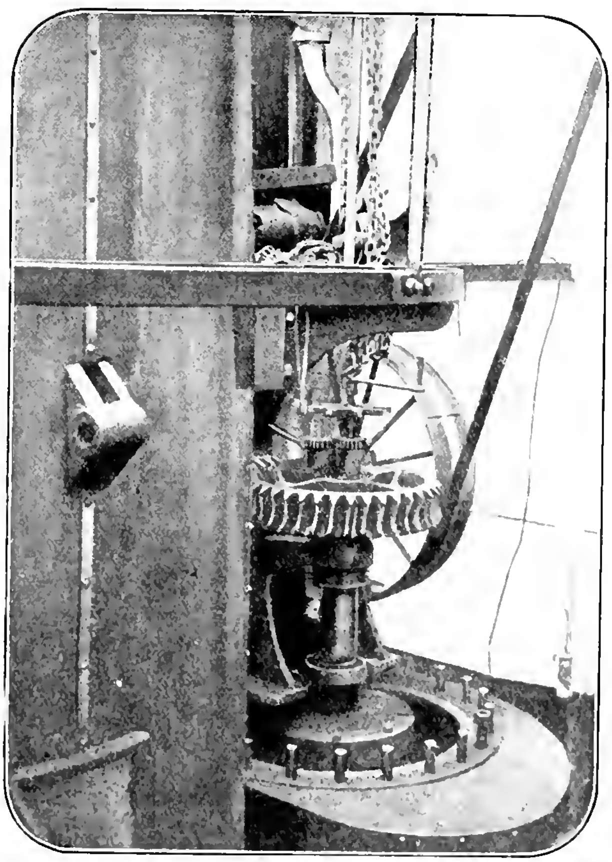
The illustration shows the rings threaded separately on six lugs, and there are therefore six points where the bush is anchored in the body of the valve, so that it cannot possibly become displaced, no matter how quick the curve. By reinforcing the valve at the weak spot, *viz.*, the hole, this is obviously a great saving of material, particularly with the large size valves, which often have to be thrown out as useless because the hole has become enlarged.

GEAR FOR BORING OUT CYLINDERS.

The boring out of cylinders is a job which must be dealt with in a manner which will not only command expedition in the doing, but steadiness and accuracy in the completion. Occasionally the fairing of a cylinder and valve face, or the boring



out of a piston valve chamber, is postponed for want of time to ensure finishing before sailing date, and in such cases the question is debated whether or not the sweet working of the engine, and the consequent



reduction in the coal account for the voyage, is of more importance than the sailing date of the steamer. In such cases the facilities which the firm on the spot can offer to undertake the work on short notice, and

give reasonable assurance of completion in a specified time, may result in the question being resolved upon in favour of the repair and the economy in running the machinery. In connection with this subject our attention has been drawn to a boring machine and work executed by it at Middlesbrough by Messrs. Raylton, Dixon & Co. The illustration shows the boring bar at work, and in this instance the work was stated, by those to whose practical experience the job appealed, to have been done speedily and satisfactorily.

PACKING FOR CONDENSER TUBES.

THE packing of condenser tubes is a somewhat tedious process, whether it be accomplished with wooden ferrules or by the more common process of plaited cotton wound into the recess in the tube plate by means of a special tool. We have recently seen some rows of condenser tubes packed experimentally with rings of fibre, and these appear to give satisfactory results with a considerable saving in time. These rings are made to suit the depth of the recess in the condenser tube—about half-inch—and to slip easily over the tube. The outside diameter being somewhat less than the screwed part of the recess, the water swells the fibre and gives a perfectly tight packing. The idea is commended to the attention of our readers.

APEXIOR COMPOSITION.

THIS preparation for internal application to Boilers, we are informed, has been used with beneficial results in many cases where it has been tried as an Anti-corrosive and a scale preventive. After trials, The Trinity House Corporation has decided to extend its use to the boilers of six of their vessels. This in itself is an indication that the composition has proved valuable, and has commended itself by experience of its use. A set of main boilers and a donkey boiler have recently been coated at Jarrow by Messrs. Dampney & Co., Ltd., with their Apexior Compound, and they are to apply their compound to three main boilers of a vessel at Liverpool. The firm has been advised by the owners of a tug boat, the boilers of which have been treated, that since using the Apexior the cleaning cost has been reduced from 90/- to 30/-, with presumably a reduction in the time required to get ready for work again after the periodical lay-up for cleaning and overhauling purposes. As a preservative this composition is applied to the bare iron or steel to give a protective surface direct to the metal.

Messrs. Leonard Chapman & Co., Importers and Manufacturers, Munton Road, London, S.E., report

Graphite, as imported, according to quality.

	£	s.	d.		£	s.	d.	
Ceylon L.L. c.i.f. London ..	18	10	0	to	41	10	0	per ton
„ O.L. „ .	13	10	0	to	41	10	0	„
„ chips „ ..	10	10	0	to	20	10	0	„
„ dust „ ..	9	0	0	to	24	10	0	„
Purified, milled and ground.								
Ceylon, 97% to 99%, f.o.b. London	50	0	0	to	63	0	0	per ton
„ 90% to 91% ..	40	0	0	to	42	0	0	„
„ 80% to 81% ..	30	0	0	to	32	0	0	„
„ 70% to 71% ..	27	0	0	to	28	0	0	
American large flake, f.o.b. London	45	0	0	to	49	0	0	
„ small .	35	0	0	to	45	0	0	
Graphite Joint Compd.	2	0	0	to	2	12	6	per cwt
Graphite Paint Paste	2	2	0	to	2	5	0	„
Graphite Paint	0	4	0	to	0	5	3	per gal

Wholesale lists of tinned goods on application.

INSTITUTE OF MARINE ENGINEERS.

THE twenty-first Annual Meeting of the Institute of Marine Engineers was held on Friday, March 18th, in the Institute premises, 58, Romford Road, Stratford, E., when Mr. James Denny presided.

The occasion was marked by a very interesting ceremony, performed by the Chairman, before proceeding with the programme of the meeting, in the unveiling of a large oil painting of Mr. James Adamson, honorary secretary, presented to the Institute in commemoration of his work in connection with the foundation of the Institute and as honorary secretary during the twenty-one years of its existence. After referring to the various activities connected with the Institute, Mr. Denny attributed the successful operation of these branches of the Institute's work to the efforts of Mr. Adamson, who, he said, might be regarded as the mainspring and flywheel of the Institute. It must be satisfactory to him and to the members to know that during the past session some recognition was made of the Institute's indebtedness to him for the work done since its inception. Part of the testimonial presented to Mr. Adamson at the Annual Dinner was to take the form of an oil painting, and that evening they saw a very excellent presentment of their honorary secretary.

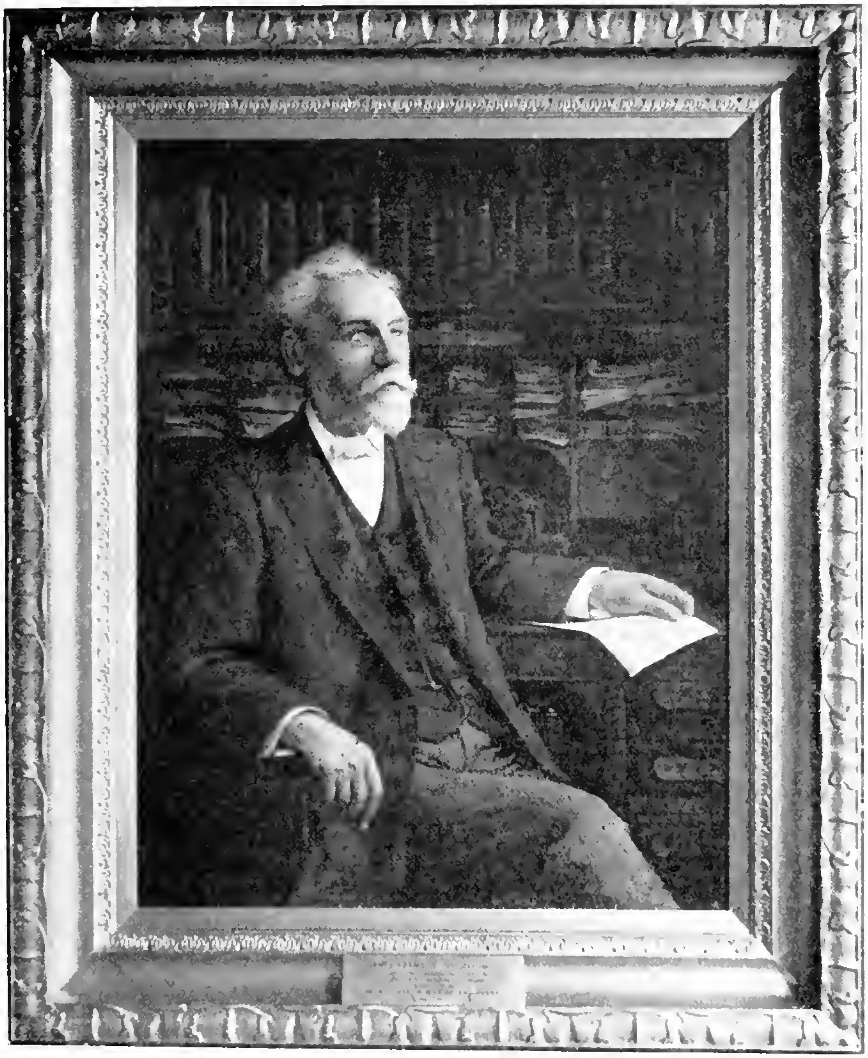
The work was executed by Mr. William Eadie, and on it being announced that the artist was present at the meeting, a vote of thanks was accorded to him on the proposal of the Chairman.

Messrs. P. Smith, R.N.R., and C. M. B. Dyer were then appointed as scrutineers of the ballot papers in connection with the election of office-bearers and members of Council.

The Annual Report was afterwards submitted by the Hon. Secretary. It was pointed out that the membership had increased from 1037 to 1175. In the Awards section the Stephen awards had been gained by Mr. Jas. S. Gander, Assoc. Member, and Mr. W. W. Adamson, Associate, for their papers on "The Turbine" and "Feed Heating" respectively. The Ritchie award for the Graduates had been gained by Mr. W. Smith for a paper on "The Functions of the Air and Circulating Pumps." The second Lloyd's Register Scholarship was won by Mr. Frank Duncanson, Graduate, of Sunderland. With regard to the question of having City premises, the committee appointed to consider the subject were unanimously of opinion that the best interests of the Institute would be furthered by transferring the headquarters from Stratford to London, and recommended that a special fund be opened for the purpose of acquiring City premises. The transactions of the Institute had been published in monthly parts during recent years, this arrangement had given general satisfaction, and sixteen papers in all, together with discussions on same, had been issued. Mr. George Shearer had been appointed representative of the Institute on the Advisory Committee, Board of Trade. Various other matters pertaining to the work of the Institute were submitted for the approval of the meeting.

The hon. treasurer, Mr. A. H. Mather, then submitted the Revenue Account and Balance Sheet for the session. In commenting upon these he pointed

out that the Revenue Account showed a balance of £106 16s. 9d., chiefly accounted for by the increased amount of subscriptions received. The amount of entrance fees was carried direct to capital account, and, including that sum, there was a nett increase on the year's working of £348 17s. 8d. The total amount of available assets standing to the credit of was very gratifying to note the large accession to the membership. The papers and lectures appeared to give great satisfaction, and in this respect he urged that more of the members should contribute to the success of the Institute in the giving of papers, attendance at the meetings, and taking part in the discussions.



Oil Painting by WILLIAM EADIE, Esq. Photo by Messrs. T. C. TURNER & Co.

JAMES ADAMSON (Hon. Secretary)
Commemorative of Twenty-one Years' Service,
including the Foundation Work
in connection with
The Institute of Marine Engineers
Session 1909-1910
(Reproduction of photograph of oil painting unveiled on the 18th March)

the Institute was £3,120 1s. 10d., of which amount £1,512 10s. 6d. was invested in securities.

The adoption of the reports was proposed by Mr. Robert Balfour, who said he was sure they would be generally considered by the members as being highly satisfactory in every respect, and they showed that the office-bearers and Council had done their duty well and at considerable personal inconvenience. It

Mr. Jas. Turner, of Tientsin, in seconding the motion, said they had their hands on the pulse of the Institute and felt the life vigorous and strong, a thing on which the executive particularly were to be congratulated. The Institute made for progress, and it was a matter to be commended that the tendency to advance was not stimulated from without, but came from within.

Various proposals with regard to the alteration of the Articles of Association and Byelaws were placed before the members by Mr. J. T. Milton, seconded by Mr. Joseph Hallett, and these were considered and discussed at length.

Mr. John Preston afterwards proposed a vote of thanks to Mr. James Denny for officiating as President during the vacancy caused by the lamented death of Mr. James Dixon. Mr. Denny, he said, had filled the office with the unfailing tact, courtesy and energy characteristic of members of the Denny firm.

The motion was seconded by Mr. J. Clark, who referred to the interest the late Mr. Dixon had shown in the Institute, as evidenced by the foundation of the Lloyd's Register Scholarships largely through his influence. His place had been taken by Mr. Denny, who had occupied the presidential chair in an ideal manner, and the policy which prompted the pioneering work for which Messrs. Denny & Co. were noted, had been exerted in the conduct of the Institute's affairs.

Mr. Denny, in responding, said that when the Council were, unfortunately, through the death of Mr. Dixon, placed in the difficulty of selecting one to fill the vacancy from the long line of distinguished past presidents, they at last decided to ask the immediate past president to take office. He himself had been the last to vacate the position and had therefore the privilege of acting as President of the Institute for a second term.

In proposing a vote of thanks to the office-bearers and members of Council, Mr. Wm. McLaren gave figures with regard to the percentage of members in the different parts of London, the attendance at meetings, etc. He referred to the value of the transactions and described the papers as being of a high standard.

Mr. Archd. Ritchie, of Hong Kong, who seconded the vote of thanks, said there were a good many members of the Institute in the Far East, and he would have pleasure in conveying to some of them an account of the evening's proceedings.

Votes of thanks were accorded to the Hon. Auditors (Messrs. J. Clark and A. Robertson) and to the Hon. Solicitor (Mr. W. Archer), and the remainder of the evening was devoted to the consideration of recommendations and suggestions for extending the usefulness of the Institute.

As a result of the Scrutineers' report, the following were declared elected office-bearers and members of Council for session 1910-11: President, Sir David Gill, K.C.M.G.; Honorary Secretary, Mr. James Adamson; Honorary Treasurer, Mr. A. H. Mather; Hon. Minute Secretary, Mr. J. G. Hawthorn; Hon. Financial Secretary, Mr. E. W. Ross; Members of Council, Messrs. J. T. Milton, H. Ruck-Keene, John Clark, John Preston and A. E. Battle. These were in addition to the following non-retiring members of Council: — Messrs. George Adams, K. C. Bales, P. T. Campbell, D. Hulme, John Lang, R.N.R., John McLaren, J. H. Silley and W. I. Taylor.

A Strong Argument.—A peculiar accident is reported to have occurred to the machinery of a dredger while undergoing trials in the neighbourhood of the Gareloch on the Clyde, preparatory to leaving for South America in March. In the course of the machinery trials the pumps were in action on the bed of the water and drew up a cannon ball among the debris into the suction, large enough to somewhat damage the gear. Surely a good certificate for the pump.

THE INSTITUTION OF NAVAL ARCHITECTS.

The spring meetings of the 51st session of the Institution of Naval Architects were opened on the 16th of last month, in the hall of the Royal Society of Arts. The Right Hon. Earl Cawdor, President of the Institution, occupied the chair. Among those present were:—Admiral Sir N. Bowden-Smith, Sir Nathaniel Barnaby, Sir Wm. White, Sir John I. Thornycroft, Admiral Sir Gerard Noel, Admiral Bacon, Admiral Oram, Admiral Fitzgerald, the Hon. C. A. Parsons, Drs. Fottinger, Glazebrook and Stanton, Captain Garcia, Signor Giovanni De Meo, Professors J. B. Henderson, Welch, Biles and Abell, Messrs. S. W. Barnaby, R. R. Bevis, G. R. Brace, H. J. Cornish, A. Denny, J. Denny, J. M. Dewar, D. J. Dunlop, J. C. Dunlop, C. E. Ellis, J. Gilchrist, A. Gracie, Gravell, Holzapfel, J. C. Inglis, J. Foster King, Kidston, A. Laing, W. J. Luke, W. J. Pratten, C. C. Scott, R. L. Scott, A. E. Seaton, Summers-Hunter, C. E. Stromeyer, S. J. P. Thearle, F. J. Trewent, R. J. Walker and A. F. Yarrow. The proceedings were opened by the president calling upon the secretary to present the annual report.

Annual Report of the Council.

The council, in their annual report, stated that the Institution had now completed its first half-century, and that the meetings to be held in London on July 5th and the following days, under the Honorary Presidency of H.R.H. The Prince of Wales, would commemorate the 50th anniversary of the foundation of the Institution. The meetings would take the form of an International Congress in Naval Architecture and Marine Engineering. The desirability of placing the Institution upon a more definite and permanent basis had led the council to recommend that incorporation under a Royal Charter should be applied for. The number of new members, associates and students elected during the past year had been 136, against which must be set a loss of 83 through death, resignation, and other causes, leaving a nett gain of 53. The membership of all classes totalled 1,895, as against 1,842, 1,796 and 1,758 respectively, in the three preceding years. Much regret was expressed at the death of the honorary treasurer, Mr. James Dixon. The vacancy thus created had been filled by the election of Mr. C. E. Ellis.

The erection of the national experimental tank had proceeded satisfactorily, and the tank would, it was expected, be shortly ready for use. The "Institution of Naval Architects" Scholarship (1900) had been awarded to Mr. C. H. Perry, of Devonport Dockyard, who was now following the course in naval architecture at Armstrong College (Durham University), Newcastle-on-Tyne. The "Elgar" Scholarship, which was on similar lines, was being offered for competition this year for the first time. The council had awarded the Institution Premium for 1909 to Dr. T. E. Stanton, of the National Physical Laboratory, for his paper on "The Resistance of Thin Plates and Models in a Current of Water"; and a similar premium to Mr. H. C. Anstey for his paper on "The Application of Internal Combustion Engines for Marine Propulsion." The president and vice-presidents having been re-elected, the following gentlemen were elected:—Vice-president, Mr. Alexander Gracie; members of council, Messrs. P. T. Caird, Champness, James Gilchrist, James Hamilton Summers-Hunter, W. J. Luke, A. E. Seaton, W. H. Whiting, Henry Withy, and Dr. Hunter; associate members of council, the Hon. T. A. Brassey, Professor Dalby and Admiral Sir Gerard Noel.

Presidential Address.

The Right Hon. Earl Cawdor, in his presidential address, observed that they were assembled under circumstances of exceptional interest. Fifty years ago on January 16th a meeting took place in that very hall, at which the following resolution was carried unanimously:—"That we who are here present do now constitute ourselves an Institution of Naval Architects, for the purpose of advancing the science and art of naval architecture." Sir John Pakington (afterwards Lord Hampton) was the first president. Sir Edward Reed, who had taken an active part in organizing the arrangements, was appointed honorary secretary. From

that time onwards the Institution had continued its useful labours, and it had ever since held, without intermission, annual meetings under the hospitable roof of the Society of Arts, to whom their debt of gratitude should be warmly acknowledged. Of those that took part in that historic meeting there still remained with them Sir Nathaniel Barnaby, to whom their heartiest congratulations must be offered. He must also mention another distinguished and venerable vice-president, Admiral Sir John Dalrymple-Hay. The history of the Institution would be dealt with at the Jubilee meetings to be held this summer to celebrate the anniversary. But he might be allowed, in opening this fifty-first session of the meetings of the Institution, to congratulate the members upon having completed the first stage of what he earnestly hoped might be a permanent and enduring record of the progress of naval architecture and marine engineering. The record of work done, and the desire to place the establishment upon a firmer footing, had caused the council to consider the advisability of incorporating the Institution. They had decided, with the full concurrence of their legal advisers, that a Royal charter would in every way answer the purposes for which incorporation was sought, and that it would, moreover, confer upon a scientific society such as theirs a higher status among allied institutions at home and abroad, and thus enhance the value of its membership. The council proposed that a formal resolution should be submitted at a special general meeting to be held on the following day. He was pleased to observe that the affairs of the Institution generally seemed to be in a highly satisfactory condition. Notwithstanding the somewhat troubled times through which the shipbuilding community had of late been passing, the applications for membership were well maintained, and the higher standard of qualifications which had been set by the council had had the effect of filling up vacancies from among candidates of undoubted ability and merit. But it was very desirable that the associate or non-professional side should be thoroughly representative of the numerous classes whose business or other interests made them desire to keep in touch with the development of naval architecture and marine engineering.

His Lordship, in continuing his address, touched upon the steam turbine, which had given so remarkable an impetus to the development of speed in ships, and which continued to grow in favour both for naval and commercial purposes, and that while the reciprocating engine still held its own for economy at lower speeds, its place in this field was being menaced by the adaptation of the turbine to vessels of moderate speeds. The comparative results of the *Otaki*, fitted with a combination of reciprocating engines and turbines, showed, it was stated, a saving of 12 per cent. of coal in favour of the combination arrangement on the round trip voyage to New Zealand made at an average speed of 12½ knots. For smaller craft, progress was steadily being made in the use of the internal combustion engine. As an auxiliary engine for use in all kinds of small boats, this type of engine had proved itself unsurpassed, but they seemed to be still some way from seeing it equal to the task of dealing with ship propulsion on a large scale. Dealing with merchant shipbuilding, His Lordship remarked that the general tendency of shipbuilding during the past year had been one of cautious but gradual revival, after the period of severe depression which marked the years 1907 and 1908. The reduction in the total of the mercantile fleet, in so far as it was due to the scrapping of useless tonnage, was a healthy sign and should tend to make for better times. In other countries the depression in shipbuilding appeared to have been more severe and rather more lasting than with us. From the United States, Germany and France, there was reported reduction in new tonnage for mercantile use. Of the total merchant-ship tonnage launched throughout the world, the United Kingdom was last year responsible for 62 per cent. The returns of tonnage did not by any means represent the total amount of work on shipbuilding account, nor yet always the most profitable, for the extent of the repair work carried out in this country was very much more important than might be supposed. It was stated that about one-fifth of the total sum expended upon shipbuilding and marine engineering went in repair work. During the past year this amount was given in the Board of Trade returns as being upwards of 8 millions sterling expended in private yards, and 2¼ millions in Government dockyards, or a total of 10¼ millions spent on repair work out of a total of about 48 millions sterling for shipbuilding generally. With regard to the Jubilee meeting a very gratifying response had been made to the invitation to firms and members of the Institution to support the guarantee fund for the entertainment of foreign guests. Rather over £5,600 had already been promised, and it was hoped that this amount would be substantially exceeded. Replies had been received from a number of foreign Ministries of Marine, and official representatives had promised to attend from various countries. The societies connected with naval architecture or marine engineering in France, Germany, the United States, Italy and Sweden had accepted the invitation to send delegates. Papers were to be contributed by members of each of these societies, and a number of important papers would be contributed by their own members. It was intended that the field covered by the papers should be thoroughly comprehensive, both as regards naval architecture and marine engineering. His Lordship outlined the programme of the Jubilee meeting, which he thought might interest members, though it was necessarily still in the provisional stage.

After the presentation of the Institution Premiums to Dr. T. E. Stanton and Mr. H. C. Anstey, the reading of the papers was proceeded with. The first paper on the agenda was "The Battleship of the future," by Rear-Admiral R. H. Bacon, which we refer to in our Editorial columns. In the afternoon, with Sir Wm. White in the chair, Dr. R. T. Glazebrook read a "Report on the progress of the National Experimental Tank," in which he described the installation which a large party went down to Bushey to inspect on the 18th of March. The next paper was by Mr. A. W. Johns on "An Account of the Society for the improvement of Naval Architecture." Mr. Johns is a member of the Royal Corps of Naval Constructors, and his paper was a very interesting one. At the annual dinner in the evening of the same day, held at the Hotel Cecil, the Earl Cawdor presided, and a large and representative company was present.

On the morning of the second day of the proceedings, a Special General Meeting was held to consider the proposed incorporation of the Institution. A formal resolution to that effect was moved, seconded and unanimously adopted. The ordinary business was then proceeded with, the first paper being by Mr. W. J. Luke (member of Council) on "Experimental investigations on wake and thrust deduction values," a very valuable paper which our readers will find dealt with in our Editorial columns. The second paper was on "Some considerations regarding the phenomena of propulsion," by Professor J. B. Henderson, which we give *in extenso* in this issue. This was followed by Mr. T. B. Abell's (a brother of Prof. Abell) contribution on "Model Screw Propeller Results—A Comparison." Later Mr. A. Murray described the apparatus which forms the subject of his paper on "A new method of ascertaining the weight of cargoes on board ship." Our readers are referred to *The Marine Engineer and Naval Architect* of September, 1909, in which we gave an illustrated notice of the invention. At the evening meeting, Mr. J. R. Barnett read his paper on "Motor Lifeboats of the Royal National Lifeboat Institution," and was followed by Mr. Linton Hope whose contribution was "The application of internal combustion engines to fishing boats and other commercial vessels." Mr. W. P. Durtnall's subject, "The substitution of the electric motor for marine propulsion," has been explained in earlier issues of this journal. Several lantern slides were shown and among those who took part in the discussion was the Hon. C. A. Parsons.

On the third and last day the principal paper on the agenda was entitled "The application of the marine steam turbine and mechanical gearing to merchant ships," contributed by the Hon. C. A. Parsons, which will be found, fully illustrated, in another part of this journal. The two remaining papers were "Notes on the measurement of shaft horse-power," briefly put by Prof. Hopkinson, and "The brittleness of mild steel due to nitrogen," by Mr. C. E. Stromeyer member of Council), which was not read. Both these papers are dealt with in this issue. The proceedings were terminated with the usual vote of thanks to the Council of the Society of Arts for the use of their hall and to Earl Cawdor for his presidency. In the afternoon a visit was paid to Bushey to inspect the National Experimental Tank mentioned in the report of the Council.

THE APPLICATION OF THE MARINE STEAM TURBINE AND MECHANICAL GEARING TO MERCHANT SHIPS.

By the Hon. C. A. PARSONS, C.B., F.R.S., D.Sc., Vice-President.

THE steam turbine has not, as yet, been applied to vessels of slow normal speed on account of the high initial cost and inferior economy in steam; further, no promising scheme has, as yet, been evolved having for its object the modification of the turbine or propeller, so as to reduce the efficient speed of revolution of the former, and increase that of the latter for vessels of 12 knots sea speed and under, and the only approach of meeting these conditions (if we except gearing propositions) has been in the combination system, where the turbine plays a secondary part in the equipment, by utilising the lower portion of the expansion of the steam between the low-pressure cylinder of the reciprocating engine and the condenser. This system was fully explained in the paper by Mr. Walker and myself at the meeting of this Institution in March, 1908.

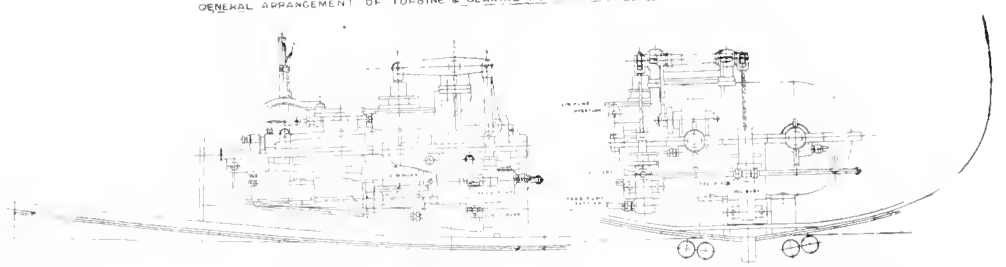
The complete and most satisfactory solution for slow-speed vessels would appear to be by means of gearing, provided speeds of rotation was, I believe, first introduced by Dr. De Laval, of Stockholm, and has been extensively used in connection with his turbine for many years with entire success, and at a moderate cost of maintenance. I have had several experimental sets constructed. One of these was a double helical gear of the De Laval type made in 1897, gearing from 9,600 revolutions of the turbine to 4,800 of the dynamo, transmitting 300 H.P. The efficiency was estimated by the method of heat loss to be above 98 per cent. This gear was cut in an ordinary universal milling machine without any special precaution as to accuracy, and I was much impressed (in spite of the obvious irregularity of the teeth) by finding how well it ran, except that it made a considerable noise.

Gears that have been recently cut by the Power Plant Company and by special machinery run with very little noise. A recent experimental set of gearing cut by Messrs. D. Brown, of Huddersfield, from 2,000 to 400 revolutions, transmitting 300 H.P. on a Heenan-Froude water brake dynamometer, gave a total loss in the gear case, including friction of gear and bearings, of $1\frac{1}{2}$ per cent.

In the summer of last year the directors of the Turbinia Works Company decided to test turbines mechanically geared to the screw shaft of an existing typical slow-speed vessel, and a cargo vessel named the *Vespasian* was purchased for this purpose.

Fig. 1

GENERAL ARRANGEMENT OF TURBINE & GEARING FOR 22 FT LAUNCH.



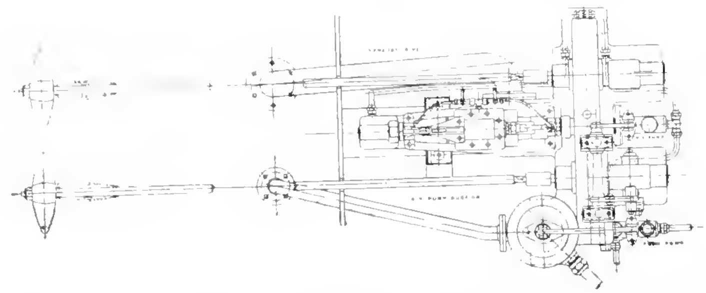
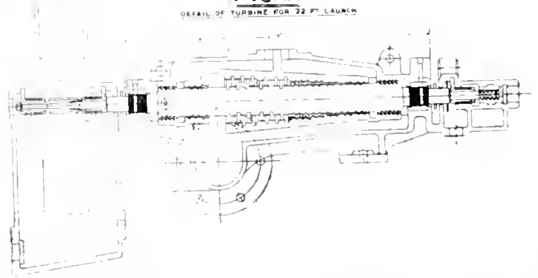


Fig. 2.

DETAIL OF TURBINE FOR 22 FT LAUNCH



the losses in transmission, first cost, and cost of maintenance are not too great. Many forms of gearing—mechanical, electrical and hydraulic—have been proposed or applied on a small scale.

I believe the first application of helical spur gearing to drive a propeller was made by The Parsons Marine Steam Turbine Company, Limited, in 1897. The turbine was of 10 H.P. geared to 2 wheels, each wheel driving a propeller shaft, as shown in Fig. 1. The revolutions of the propellers were 1,400 per minute, and the ratio of the gear 14 to 1. The turbine was of the Parsons type, with a reversing turbine on the same shaft incorporated in the same casing (Fig. 2.). The gear was single helical, as shown in Fig. 3. The turbine took part of the thrust of the propeller, the remaining thrust being taken on the thrust bearing in the gear casing. The air, circulating, and oil pumps were driven by worm gearing off one of the screw shafts, as shown in Fig. 1. The launch was 22 ft. over all, and attained a speed of 9 miles an hour. This launch was built to the order of Mr. F. B. Atkinson, for his yacht *Charmian*. The launch was sent to the Turbinia Works in 1904, and the turbine was generally overhauled and cleaned. The gear was found to be in perfect order, and did not require any repair.

Helical and double helical gear of fine pitch suited to high

* Read at the Spring Meetings of the Fifty-first Session of the Institution of Naval Architects, March 18th, 1910.

The *Vespasian* was built in 1887 by Messrs. Short Brothers of Sunderland. Her dimensions are :—Length on load water line, 275 ft. ; breadth moulded, 38 ft. 9 in. ; depth moulded, 21 ft. 2 in. ; mean loaded draught, 19 ft. 8 in. and displacement, 4,350 tons.

Previous to installing turbine engines with reduction gear, the vessel was fitted with an ordinary triple-expansion surface condensing engine by Mr. G. Clark, of Sunderland, with cylinders $22\frac{1}{2}$ in. by 35 in. by 59 in. and 42 in. stroke. The air, circulating, feed and bilge pumps were driven from the intermediate-pressure crosshead, with the usual arrangement of levers and links. The condenser was cast with the back columns of the main engine, and had a cooling surface of 1,770 sq. ft. The boilers—two in number—are 13 ft. diameter by 10 ft. 6 in. long, with a total heating surface of 3,430 sq. ft., and grate area of 98 sq. ft., working under a pressure of 150 lbs. with natural draught. The propeller is of cast iron, and has four blades, having a diameter of 14 ft., pitch 16·35 ft., and expanded area of 70 sq. ft.

With a view to obtaining comparative data between the turbine installation and the reciprocating engine, it was decided to run trials with the vessel with her reciprocating engine previous to its removal and the installing of the turbines and gearing.

Fig. 4 shows a profile of the vessel, and Fig. 5 a general arrangement of the reciprocating engine and boilers.¶

Before proceeding on the voyage upon which data regarding

the performance of the reciprocating engine were taken, the propelling machinery was completely dismantled and overhauled. The high-pressure piston valve chamber was rebored and new valve rings fitted; slide valves were replaned and faced up; bearings were renewed, and other repairs carried out wherever necessary to bring the machinery into an efficient condition and first-class working order. To obtain reliable measurements of water consumption, two tanks were fitted, each of 400 gallons capacity, with suitable change cocks and connections for the air pump to discharge through these measuring tanks.

Figure 6 (full lines) shows the results of the progressive trial to a basis of speed of vessel. The effective horse-power shown on this diagram is calculated from the resistance as obtained from a model experiment of the vessel to a scale of ¼ in. to the foot.

Figure 7 (full lines) shows the results as obtained on the voyage, plotted to a basis of revolutions. For the sake of comparison, the indicated horse-power taken on the progressive trial is also shown, together with the speed corresponding to revolutions taken on measured mile.

Figure 8 (full lines) shows the water consumption per

Fig. 3

DETAIL OF GEAR.

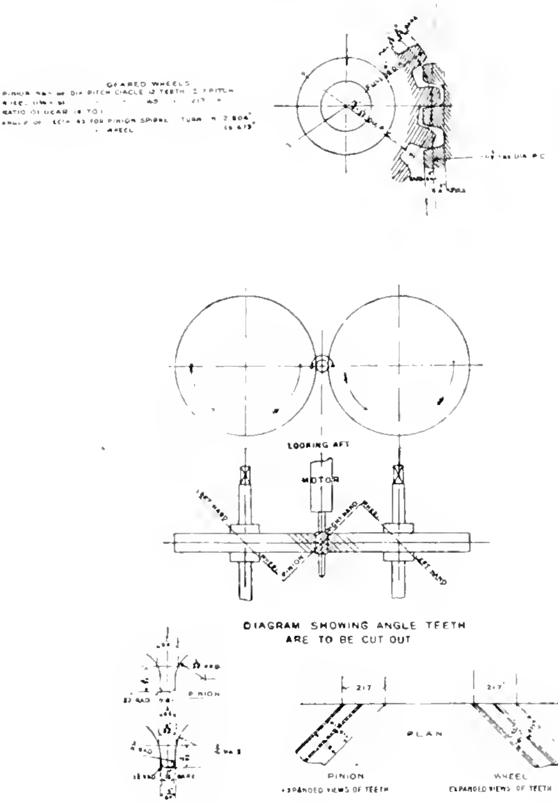
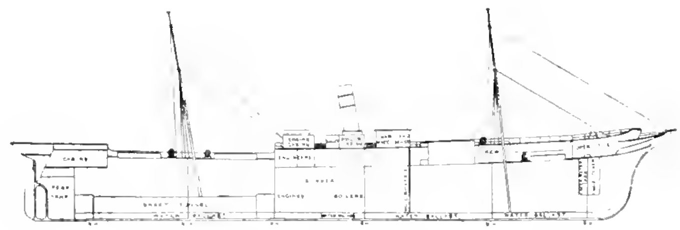


Fig. 4.

PROFILE



hour for main engines only and for all purposes to a basis of revolutions. The difference between these two curves represents the consumption of steam of steering engine, the exhaust of which was led to a separate measuring tank.

Figure 9 shows the water per indicated horse-power, also plotted to a basis of revolutions; and

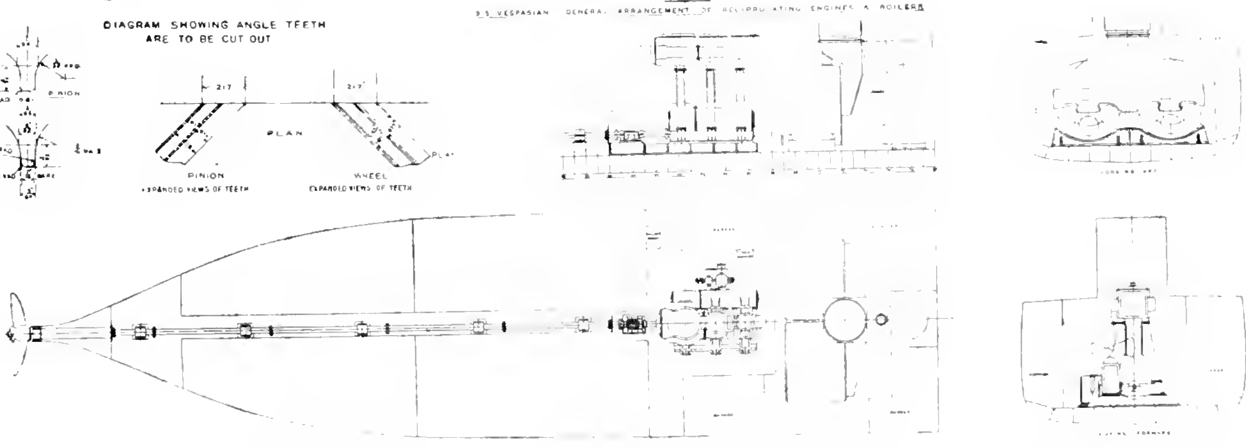
Figure 10 shows the propulsive co-efficient plotted to a basis of speed.

On the completion of the voyage the vessel returned to the Turbinia Works, where her reciprocating engine was taken out, engine seats re-modelled, and preparations made for the reception of the turbines and gearing.

Figure 12 shows the general ararngement of the turbine machinery and gearing.

Fig 5

S.S. VESPASIAN GENERAL ARRANGEMENT OF RECIPROCATING ENGINES & BOILERS



It was necessary, for the purpose of obtaining data under service conditions, that the vessel should be run at her loaded condition. Arrangements were consequently made with a local firm of shipbrokers to take a cargo of coal from the Tyne to Malta, and on June 26th last year, the *Vespasian* left the Tyne in a loaded condition with a special recording staff on board, and on this voyage careful measurements of coal and water consumption were made.

The data and results of a progressive trial carried out on the Whitley Bay mile are given in the Appendix, from which, together with the data taken on the voyage referred to, the curves in figures 6, 7, 8, 9 and 10 have been plotted.

The only alteration made to the vessel was in the type of propelling engines; the boilers, propeller, shafting and thrust blocks remained the same as for the reciprocating engine.

The propelling machinery consists of two turbines in "series," *i.e.*, one high pressure and one low pressure, the high pressure turbine being placed on the starboard side of the vessel and the low pressure on the port side. At the after end of each of the turbines a driving pinion is connected with a flexible coupling between the pinion shaft and the turbine, the pinion on each side of the vessel being geared into a wheel, which is coupled to the propeller shaft.

A reversing turbine is incorporated in the exhaust casing of the low pressure turbine. The air, circulating, feed and

Fig. 6.

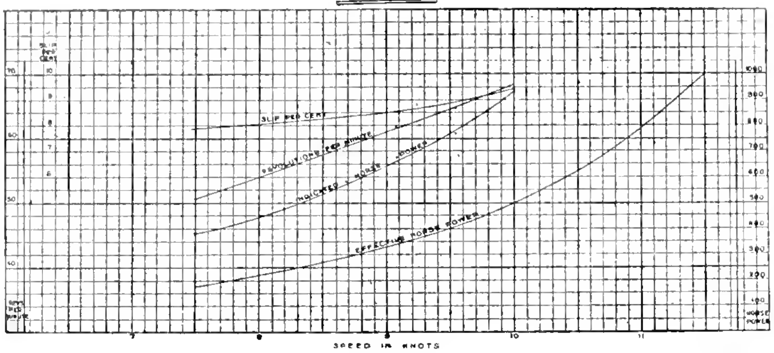
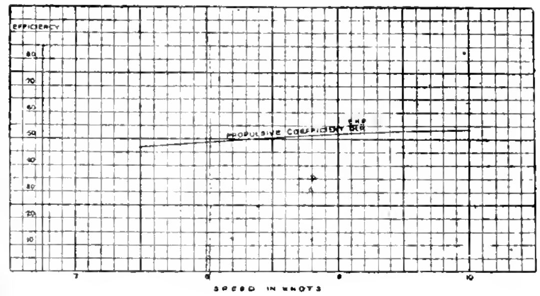


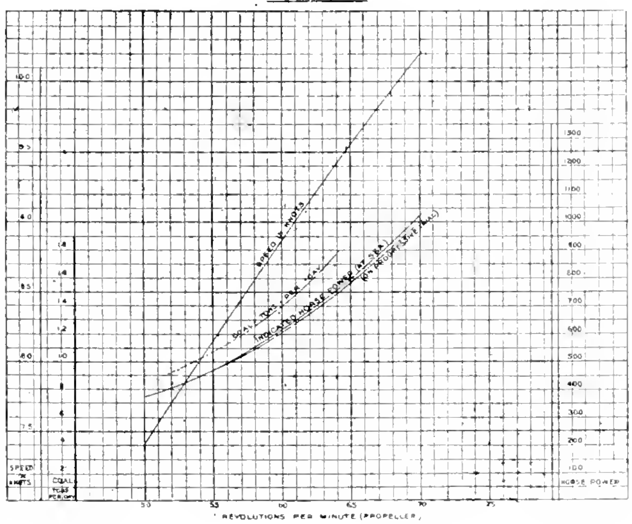
Fig. 10.



bilge pumps are of the usual design for tramp steamers, and are driven by means of a crank and connecting rod coupled to the forward end of the gear wheel shaft. The turbine and pinion shaft bearings are under forced lubrication, similar to ordinary turbine practice. The teeth of the pinions and of the gear wheel are lubricated by means of a "spray" pipe extending the full width of the face of the wheel. Independent oil pumps are fitted for supplying oil to the bearings and gear wheel. With a view to the possibility of experimenting with different lubricants for the gear wheel, the oiling system for the bearings is separate from that of the gear wheel.

The high-pressure turbine is 3 ft. maximum diameter by 13 ft. over-all length, and the low-pressure 3 ft. 10 in. diameter by 12 ft. 6 in. length. The turbines are

Fig. 7.



similar in design to a land turbine, being balanced for steam thrust only, the propeller thrust being taken up by the ordinary thrust-block of the horse-shoe type, which is fitted aft of the gear wheel.

A new condenser, together with a vacuum augmentor, is fitted with the turbine installation. The cooling surface of the condenser is 1,165 sq. ft.

The gear wheel is of cast iron, with two forged steel rims shrunk on. The diameter of the wheel is 8 ft. $3\frac{1}{2}$ in. pitch circle, having 398 teeth—double helical—with a circular pitch of ·7854 in. The total width of face of wheel is 24 in.; inclination of teeth 20° to the axis.

The pinion shafts are of chrome nickel steel, 5 in. diameter pitch circle, with 20 teeth ·7854 circular pitch. The ratio of gear is 19·9 to 1.

Fig. 8.

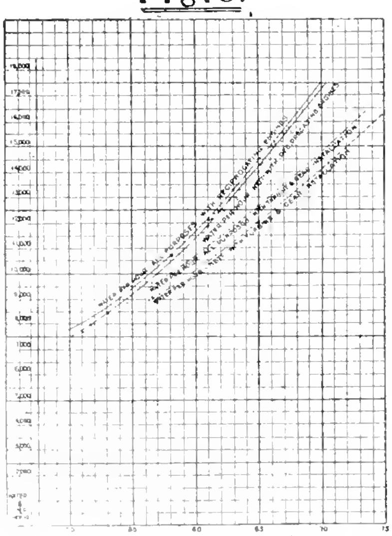


Fig. 9.

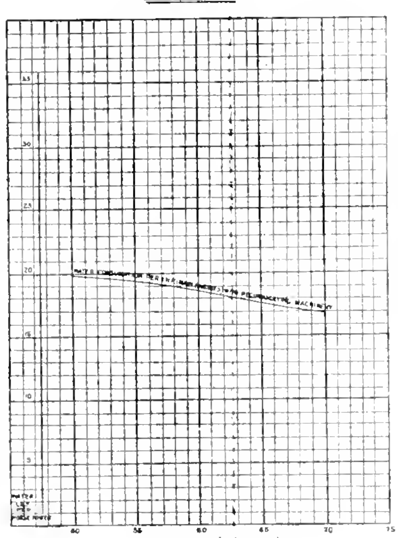
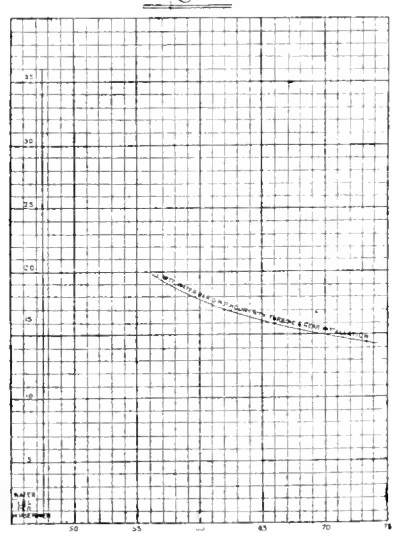


Fig. 11.



S S VESPASIAN GENERAL ARRANGEMENT OF TURBINES & GEARING

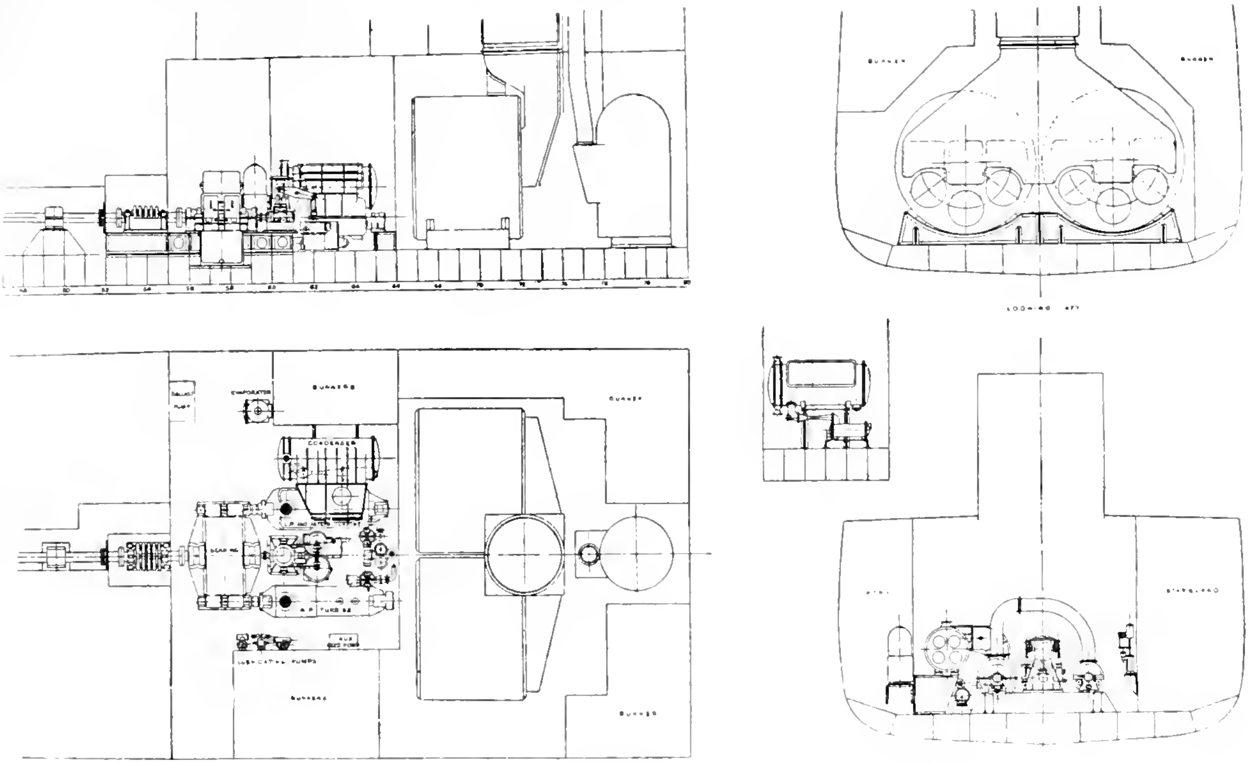


Fig 12

APPENDIX

S.S. "VESPASIAN" PROGRESSIVE TRIAL ON HARTLEY MILE, WITH RECIPROCATING ENGINES

Draught taken at Whitley Bay Draught forward, 19 ft 1 in, draught, aft, 20 ft. 3 in., draught, mean, 19 ft 8 in. Dimensions, moulded, 275 ft by 38·75 ft by 21·16 ft Displacement, 4,350 tons; co-eff, ·754 Propeller, solid cast iron, 4 blades, diameter, 14 ft ; pitch, 16·35 ft, expanded area, 10,100 sq in

Measured mile at Hartley. High-pressure cylinder, diam, 22¼ in, mean cut off, 71 %, intermediate cylinder, diam, 35 in, mean cut off, 63 %; low-pressure cylinder, diam, 59 in, mean cut off, 64 %. stroke, 42 in

Direction of run	S	N	Mean	S	N	Mean	S	N	Mean	S	N	Mean
Speed	7·438	7·563	7·50	8·531	7·860	8·195	9·278	8·090	8·684	11·009	9·399	10·204
Revolutions per minute ..	49·9	51·27	50·58	55·1	55·5	55·3	58·4	59·3	58·85	70·0	70·1	70·05
Boiler pressure in lbs. ..	126	130	128	138	129	133·5	135	143	139	152	149	150·5
H.P. Receiver pressure ..	73	72	72·5	82	84	83	95	95	95	128·5	127·5	128
I.P. Receiver pressure .	17·5	17·25	17·37	20·5	22	21·25	26	26	26	44	45	44·5
L.P. Receiver pressure .	-4·75	-6	-5·37	-4·5	-4·75	-4·62	-3·37	-2·75	-3·06	3	3·62	3·31
L.P. exhaust pressure .	27·0"	27·0"	27·0"	27·0"	27·0"	27·0"	26·8"	26·8"	26·8"	25·2"	25·2"	25·[illegible]
Vacuum .. .	28·25"	28·37"	28·31"	28·5"	28·5"	28·5"	28·5"	28·5"	28·25"	26·5"	26·5"	[illegible]
Barometer ..	29·96"		—		—	—	—	—	—	—	—	—
Mean H.P. Pressure ..	30·75	30·35	30·55	34·25	34·85	34·55	37·3	38·15	37·72	47·6	47·95	47·77
Mean I.P. Pressure ..	13·8	13·85	13·82	14·8	14·6	14·70	17·25	17·45	17·35	24·8	24·65	24·7
Mean L.P. Pressure ..	3·91	4·125	4·01	4·8	4·57	4·8	5·61	5·91	5·76	8·86	9·51	9·18
I.H.P., H.P. ..	124	126	125	152·5	156·5	154·5	176	183	179·5	269	272	27[illegible]
I.H.P., I.P. .	139	143·5	141·2	164·5	164	164·2	204	209	206·5	351	348	[illegible]
I.H.P., L.P. ..	113	122	117·5	153	156·5	154·7	189·5	203	196·2	359	387	[illegible]
I.H.P., Total ..	376	391·5	383·7	470	477	473·5	569·5	595	582	979	1007	99[illegible]
Temp. Circ. Inlet	55·5	—	—	—		—			—		—	
,, ,, Disc	76	81	78·5	87	87	87	91	90	90·5	106	107	106·5
,, Hotwell ..	73	71	72	81	85	83	91	92	91·5	118	119	118

Direction of run	S	N	Mean	S	N	Mean	S	N	Mean	N	S	Mean
Speed	10·778	9·068	9·923	10·315	8·759	9·537	9·800	8·824	9·316	8·824	9·326	9·075
Revolutions per minute ..	67·4	68·27	67·83	64·9	64·36	64·63	62·0	62·1	62·05	62·1	61·3	61·7
Boiler pressure in lbs. ..	142·5	130	136·2	14[illegible]	132	137·5	128	128	128	128	120	124
H.P. Receiver pressure ..	120·5	115	117·75	113	107	110	101	102	101	102	100	101
I.P. Receiver pressure .	40·0	42	41·[illegible]	[illegible]6·5	35·5	36	31	30·5	30·75	[illegible]·5	32	31·25
L.P. Receiver pressure .	1·5	2·75	2·1[illegible]	[illegible]	-1·0	[illegible]	1·5	1·5	[illegible]	-1·[illegible]	2·5	-2
L.P. exhaust pressure .	[illegible]·75"	25·5"	25·6	26·2"	26·0"	26·1"	26·25"	26·25"	26·25	26·25"	26·25"	26·25
Vacuum .. .	27·25"	26·87"	27·06	27·67"	27·37"	27·52"	27·5"	27·75	27·62	27·75"	27·67"	27·71
Barometer ..												
Mean H.P. Pressure ..	41·12	[illegible]	43·[illegible]	41·85	42·25	42·[illegible]	[illegible]	[illegible]	39·9	40·5	40·5	40·5
Mean I.P. Pressure ..	23·[illegible]	24·67	[illegible]	21·7	[illegible]	21·[illegible]	[illegible]	19·7	19·97	19·7	20	20·12
Mean L.P. Pressure ..	8·42	8·8	8·61	7·18	6·66	7[illegible]	6·[illegible]	6·[illegible]	6·31	6	5·8[illegible]	6·16
I.H.P., H.P. ..	241	25[illegible]	2[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2[illegible]	20[illegible]	20[illegible]	2[illegible]4	202·2
I.H.P., I.P. .	[illegible]	3[illegible]	[illegible]5·2	25[illegible]	256	[illegible]	[illegible]	247	2[illegible]	247	254·5	250
I.H.P., L.P. ..	[illegible]5·5	[illegible]	[illegible]36	2[illegible]	[illegible]	[illegible]61	227	2[illegible]	2[illegible]	[illegible]	206·5	220
I.H.P., Total ..	[illegible]85·5	[illegible]022	[illegible]	[illegible]	70[illegible]	709	6[illegible]	684	681	684	662	67[illegible]
Temp. Circ. Inlet												
,, ,, Disc	101	104	102	[illegible]7	[illegible]	[illegible]7	[illegible]	91	91·2	94	94	94
,, Hotwell ..	112	116	114	[illegible]	[illegible]	[illegible]	91	9[illegible]	9[illegible]	[illegible]	94	93·[illegible]

On the completion of the erection, on board, of the turbine-gearing installation at the end of February of this year, the vessel was loaded to the same draught and displacement as that under which the trials referred to in the Appendix were run. As already mentioned, the propeller has not been touched or altered in any way. In the short interval since the completion of her alterations, the vessel has been out to sea on four occasions.

The following table gives the data and results of a run made off the Tyne on the Eleventh of April at varying revolutions:

Speed in knots	8·4	9·56	10·5	10·66
Revolutions per minute ..	56·5	65·0	71·3	73·3
Boiler pressure	145	144	140	145
Initial pressure H.P. turbine	60 lbs.	86 lbs.	110 lbs.	121 lbs.
Initial pressure L.P. turbine	15·2 in.	12·5 in.	7·1 in.	5·5 in.
Vacuum ..	28·8 in.	28·8 in.	28·7 in.	28·5 in.
Barometer ..	29·9 in.			
Shaft horse-power ..	456	740	980	1,095
Water consumption per hour, main engines	9,070 lbs.	12,000 lbs.	14,480 lbs.	15,670 lbs.
Water consumption, all purposes ..	9,670 lbs.	12,020 lbs.	15,120 lbs.	16,370 lbs
Water consumption per shaft horse-power, main engines	19·8 lbs.	16·2 lbs.	14·8 lbs.	14·3 lbs.

The water consumptions per hour at the several rates of revolutions have been plotted on Figure 8, shown in full lines for the reciprocating engines and in dotted lines for the turbine geared engines.

It will be noted that under normal full speed steaming conditions an increase of about one knot is obtained with the same coal consumption.

Figure 11 shows the water consumption per shaft horse-power for the geared turbines.

It will be noted that the observed mean speeds on the measured mile given in the above table correspond to the speeds obtained with the reciprocating engines at the same revolutions, thus eliminating any necessity for allowances, the weather conditions in the two cases being very similar.

It may be mentioned that the turbines and gearing have given no trouble, and have worked satisfactorily with very little noise or vibration throughout the trials. Further, there is no appreciable wear on the teeth or bearings.

It is proposed to put the vessel into commission and run extended trials.

THE INSTITUTION OF CIVIL ENGINEERS.—At the Students' Meeting held at the Institution on Friday, the 18th March, Mr. N. Maas read a paper on "The Construction of Warships." The author, after dealing briefly with the stresses to which a vessel is subjected, proceeded to describe in detail the construction of a warship, from the selection of a site to the final fitting out. An interesting discussion followed, in which Messrs. J. E. Burkhardt, G. Lees, Ward, W. P. Warlow, J. F. Peebles, N. Smith, G. Lacey and M. H. Schwab took part. By the kindness of the Chairman, some interesting models of warships, machinery, and of a mould-loft floor, from the Thames Ironworks, were exhibited and explained.

NAVAL AND MERCANTILE MARINE EXHIBITION.—A largely attended meeting of the organizing committee in connection with the Exhibition which is to be opened in September at Olympia, was held on March 22nd, under the chairmanship of Capt. Sankey. The progress reported was exceedingly favourable to the prospects of the promoters, and the results bid fair towards a successful issue to the undertaking, as the space already booked appears to cover a large portion of the building. Allied with the engineering section there will also be a chemical industry section. This is as it should be, the two industries are so nearly allied to one another that the best educational results should follow the combination. Sir David Gill, K.C.B. F.R.S. has accepted the Presidency of the Exhibition.

NOTES ON THE MEASUREMENT OF SHAFT HORSE POWER.*

Relation between Twist and Torque.

By Professor B. HOPKINSON, D.Sc., Associate.

THE measurement of shaft horse-power in a turbine-driven vessel is based on the reading of a torsionmeter which measures the angular twist of some portion of the shaft. The twist is proportional to the torque in foot lbs. transmitted by the shaft, and, in order to determine this torque, it is necessary to know the constant ratio which it bears to the angular twist. This connecting factor is usually measured directly by mounting the shaft on bearings before it is placed in the vessel, applying a twisting couple by means of levers and weights and measuring the corresponding twist by means of the torsionmeter. This plan has obvious advantages, and will probably be adopted wherever it is possible. In some cases, however, it may be impossible, or at least very inconvenient, to carry out a test of this kind, and it will then be necessary to calculate the constant for the shaft from its dimensions and the modulus of rigidity of the material of which it is made. The author has made, or has seen the results of, a considerable number of static tests of shafting which go to show that, if the modulus of rigidity be assumed to be 12,000,000 lbs. per square inch, the stiffness of the shaft so calculated is nearly always correct within about 4 per cent. The following figures, which have been furnished to the author by Messrs. Siemens Bros., illustrate the variations in rigidity which may occur.

No. of Shaft.	Modulus of Rigidity $\times 10^{-6}$.		No. of Shaft	Modulus of Rigidity $\times 10^{-6}$.	
	By Pointers.	By Torsionmeter.		By Pointers.	By Torsionmeter.
1.	12·10	12·40	9.	12·10	11·88
2.	11·88	12·44	10.	12·01	12·35
3.	12·07	12·13	11.	12·05	11·94
4.	11·90	12·65	12.	12·00	12·23
5.	12·23	12·33	13.	12·22	12·09
6.	11·88	12·07	14.	11·94	12·08
7.	12·26	12·24	15.	11·93	12·03
8.	12·09	11·96	16.	11·91	12·03

Of the sixteen shafts referred to, the first twelve were $9\frac{7}{8}$ in. diameter, and the last four $10\frac{3}{4}$ in. Each shaft was mounted in the builders' yard and loaded by levers and weights. The twist was observed by means of long pointers fixed to the shaft at distances ranging in different cases from 7 ft. 6 in. to 14 in., and also by a Hopkinson-Thring torsionmeter, which measures the twist over a length of about 3 ft. The modulus of rigidity was calculated in the usual way from the twist and torque so measured.

It will be seen that in all but one case out of the sixteen the modulus, by whichever method it be measured, is within 4 per cent. of 12,000,000. It may also be observed that the twist as measured by torsionmeter frequently differs considerably from that registered by the pointers under the same conditions of stress, the difference reaching 6 per cent. in one case.

The author has little doubt that the twist recorded by the torsionmeter under these conditions of static loading was correct within 1 per cent., and, although he was not present at these trials, he thinks it most probable that a similar degree of accuracy was reached with the pointers. If this be so, the results indicate that the twist per foot on the 3-ft. length covered by the torsionmeter may sometimes differ by as much as 4 per cent. from the mean twist over several times that length, which is registered by the pointers. In other words, the variation of rigidity from point to point of the same shaft is of the same order of magnitude as the variation from one shaft to another. Hence the increase of accuracy obtained by calibrating the shaft before it goes into the vessel, instead of proceeding by calculation with an

* Read at the Spring Meetings of the Fifty-first Session of the Institution of Naval Architects, March 18th, 1910.

assumed modulus, will be largely illusory, unless the calibration be performed with the torsionmeter fixed at that point on the shaft where it is going to be used.

The circumstances of calibration of the shaft differ from those obtaining in the vessel in that there is no end thrust. In the ship, when the shaft is working at full power, the end thrust may reach 1,000 lbs. per square inch. It is a question of some importance whether the presence of this thrust affects the relation between torque and twist. Such an effect might conceivably arise in either of two ways. There might be a direct effect of longitudinal stress upon the modulus of rigidity; a shaft under compression might twist either more or less for a given increment of torque than when free. Such a change of modulus implies a deviation from Hooke's Law, but it is not impossible that it exists, though it does not appear to have been observed except to a very minute amount. On the other hand, longitudinal thrust or tension may produce twist in the shaft in the absence of torque, and this twist due to the thrust will be added to the twist produced by torque, the resultant twist being the sum of these two elements. To put the matter in symbols: the twist, instead of being represented by a T, where T is the torque in foot lbs., and a a constant dependent on the modulus of rigidity and the dimensions, must be represented by a T + b R, where R is the longitudinal stress. The kind of result which would be obtained in the calibration of a shaft such as this is shown in Fig. 5, in which O B represents the calibration line when the shaft is twisted in the ordinary way without end thrust, while C D represents a similar line when a thrust is applied. The thrust is supposed to be applied when there is no torque in the shaft giving rise to a small twist O C, and the line C D, which is parallel to O B, shows the increment of twist consequent on the application of torque, the thrust being maintained constant. The dotted line O D would then give approximately the calibration of the shaft when an increasing torque is applied concurrently with a proportionately increasing thrust. The result, for the practical purpose of measuring shaft horsepower, is much the same as though the modulus had been increased, though physically it cannot be so regarded.

The production of twist by means of a longitudinal pull or push, in the absence of any torque, implies a peculiar structure in the shaft, which may perhaps be best described as a helical arrangement of the fibres. A rope when pulled tends to untwist, and circumstances of manufacture or treatment may sometimes produce an analogous structure in a metal rod or shaft. It seems improbable that the ordinary processes of manufacture of a propeller shaft could have any such result, but it cannot be regarded as impossible without more experimental evidence than we at present possess. Overstraining by the application of a torque exceeding the elastic limit would certainly produce a structure of the kind required; and, though it is most unlikely that such overstraining would occur after the shaft is finished, there is at least a possibility that local treatment in forging may have a similar effect. The question requires further experimental investigation on full-sized shafts.* The experiment would consist simply in applying a pure end thrust or tension to a shaft and ascertaining whether or no any measurable twist is produced thereby.

Fig. 2

Fig. 1

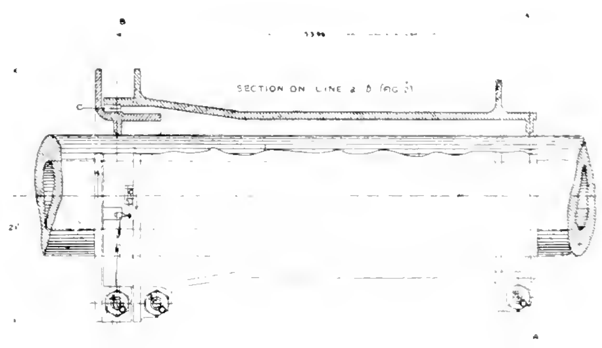
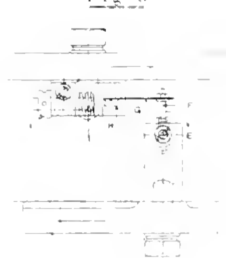


Fig. 3



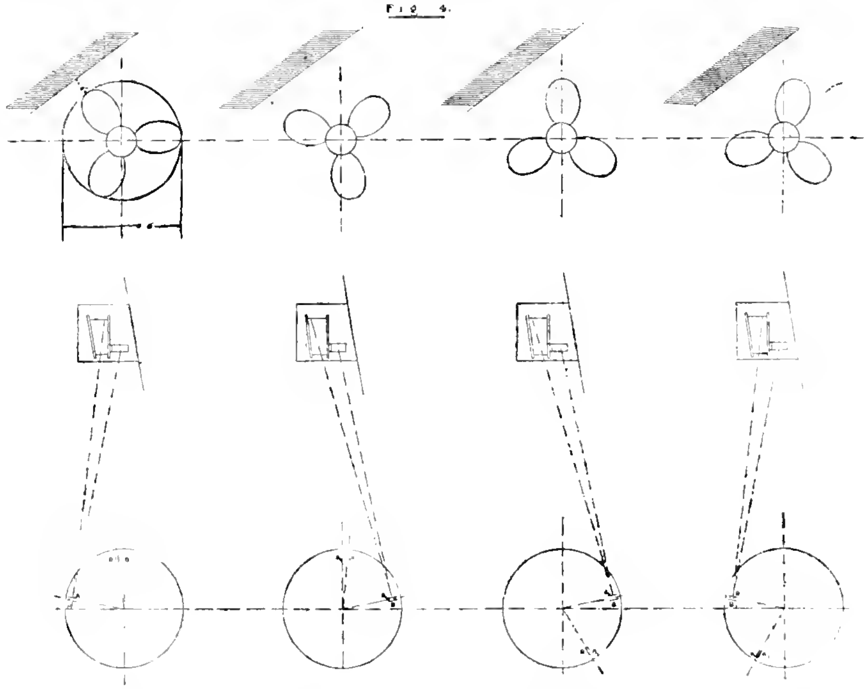
Variation of Torque in a Revolution

Most of the torsionmeters which have come into practical use measure the twist which instantaneously exists in the

* Mr. Hamilton Gibson has recorded some observations on a large shaft which show an effect which may have been of this kind; though the observations are apparently also consistent with a change of modulus. Trans. I. N. A., March, 1907.

shaft at one or more definite points in a revolution. For example, the Denny-Johnson instrument measures the twist at the moment when the small magnet carried on the wheel passes the coils connected to the telephone, and in the instrument designed by the author and Mr. Thring the measurement is made at the moment when the flash is on the screen. In the simplest form of such instruments the measurement is made at one point only, and it has then to be assumed for the purpose of calculating the horse-power that the instantaneous torque at this single point fairly represents the average during the revolution. Such an assumption, though obviously erroneous where reciprocating engines are used, has much probability of truth when the motive power is a steam turbine, because there is then no variation in turning moment due to the engine. Even here, however, it is possible that the varying resistance experienced by the propeller due to the changing positions of its blades in relation to the surface of the water or the hull of the vessel may cause appreciable changes of torque. The author has not seen any published results of observations bearing on the question whether such changes are of practical importance, though probably such observations have been made. He thinks it therefore desirable to place on record some results of this character, partly obtained by himself and partly by the arrows (Fig. 1). In order to render this relative motion visible, a mirror is used, which is shown in detail in Fig. 3. A pair of mirrors facing opposite ways are carried in a metal frame which can turn on pivots about an axis E, which is fixed relative to the collar. This frame carries an arm F, which is connected by means of a flexible spring G to a block H fixed to the flange of the sleeve. When the shaft twists the relative motion of the sleeve and collar flanges causes the mirror to turn about the axis E as shown by the arrow. The spring strut G, while retaining its length practically invariable, and so making the motion of the end of the arm the same as the relative motion of the sleeve and collar, is able to bend slightly, and so to take up the angular movement of the arm. A screw nut I serves to give slight movement to the block H relative to the flange, and thus to adjust the zero reading of the mirror to any desired point. By means of the same screw, the pitch of which is accurately known, it is also possible to determine, after the instrument is fixed in place, the deflection on the scale corresponding to a given relative movement of the two flanges. The movement of the mirror is observed by means of a straight filament lamp J, an image of which is formed by the mirror on a ground-glass screen K placed parallel to the axis of the shaft. It is obvious that the movement of this image across

Fig. 4.



others under conditions of which he has an intimate knowledge. It may be said at once that the general effect of these observations is to support the conclusion that a single point measurement of the torque in a turbine-driven propeller shaft sufficiently nearly represents the average over a revolution, unless in quite exceptional circumstances.

The general principle of the Hopkinson-Thring torsionmeter with which these observations were made is probably familiar to most of those who are interested in the measurement of shaft horse-power. A short description of the latest pattern of this instrument as manufactured by Messrs. Siemens Brothers may, however, be interesting.

Figs. 1 and 2 show in plan, part section and end elevation, the size of meter used for shafts from 8 to 12 in. in diameter. Referring to Fig. 1, the sleeve is clamped on to the shaft in the plane A A and the collar in the plane B B. Two bearing plates C C (Fig. 2) are carried on the inside of the sleeve and are kept in engagement with the corresponding plates on the collar by means of the spring D, which is fixed to the sleeve and pressed against the collar. The sleeve and collar are thus kept concentric, and the twist of the shaft between the planes A A and B B appears as relative motion of the opposed flanges of the sleeve and collar as shown by the scale will be proportional to the twist in the shaft, and, further, that for a single mirror this image will be thrown upon the screen at one point only in the revolution. In the standard fitting, as now supplied, however, there are, as already stated, two mirrors placed back to back in the same frame, and there will therefore be two reflections, one from each mirror, corresponding to two points in a revolution which are nearly, but not quite, 180° apart (see Fig. 2). These reflections, though occurring intermittently and at different times, will, if the speed of revolution exceeds a moderate amount, appear as continuous lines on the screen. They are, however, easily identified by an arrangement of the screen with clear glass slots, of which it is unnecessary to give particulars. Identification is rendered easier by the fact that with the same direction of twist the two reflections move opposite ways.

It is obvious that by putting on more mirrors at different points round the circumference the number of observations in the course of a revolution may be increased, and in the set of experiments made by the author with the special object of measuring the change of torque in a revolution due to propeller action, a second pair of mirrors was added, so as to secure four observations in a revolution. These measurements were made on a wing shaft, which it was thought

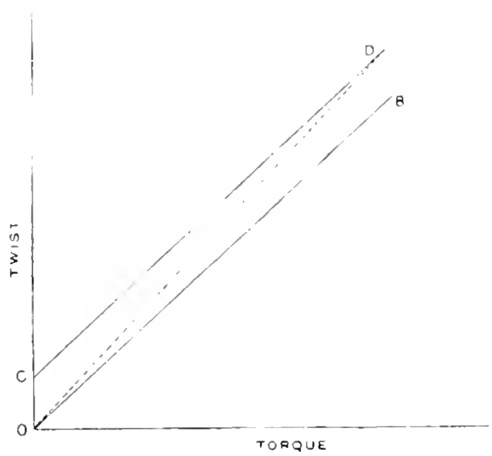
would be most likely to show changes of torque of the amount contemplated, because the propeller blades come rather close to the hull of the vessel, and, it was supposed, might then experience a considerably augmented resistance. The disposition of mirrors is shown in Fig. 4, which gives the position of the propeller blades at the instant when each of the four reflections passes the screen. It will be seen that the points of observation are fairly evenly distributed over the cycle of relative position of blade and hull, which, of course, occupies one-third of a revolution. Readings were taken at several different speeds and powers, but no difference could be certainly detected between the four mirrors. The actual figures for nearly full power and for about one-third of full power were as follows :—

Mirror.	A	A_1	B	B_1	Mean.
Full-power readings	89	90	89	90	89½
One-third of full-power	42	43	41	42	42

The zeros were obtained by trailing. It will be seen that, assuming the mean of the four mirrors to be correct, the error in the torque obtained from any single one is not more than about 1 per cent. of the full-power torque.

It is, of course, possible, that the actual changes in resistance experienced by the propeller are considerably greater than these figures would indicate, but that these changes are met by the flywheel action of the propeller. The relation

Fig. 5



between the actual change in the instantaneous couple exerted by the water on the propeller and the corresponding change recorded by the torsionmeter will depend upon the relation between the period of variation of the couple, which with a three-blade propeller will be one-third of that of the revolution of the shaft, and the natural period of torsional oscillations in the shaft, being given (in theory) by the formula—

$$\frac{n^2}{n^2-1}$$

where n is the ratio of these two periods. In the case of the vessel in which these experiments were made, the author had not complete data for calculating the natural period, but it was probably about $\frac{1}{10}$ second. At full speed the period of change of couple would be $\frac{1}{15}$ second. From the fact that these periods are not very greatly different, and that, so far as the author was able to observe, there was no marked change in torque at a speed of about 200 revolutions per minute (at which n would be equal to 1, and resonance would occur), the author is inclined to conclude that there was really very little difference in the actual resistance experienced by the propeller at different points, and that the absence of indications of such difference in the torsionmeter readings was not merely due to the flywheel effect of the propeller. It is, of course, possible that with a four-blade propeller the changes might be more marked.

The general conclusion that the torque does not vary perceptibly in a revolution in ordinary cases is supported by a number of other observations. It has already been said that the standard form of the Hopkinson-Thring torsionmeter always gives at least two readings in a revolution. Observations have now been taken with this instrument on a considerable number of shafts in different vessels, and, so far as the author is aware, no case has yet been recorded in which the readings of either mirror at full power differ by more than 2 per cent. from the mean of the two, and the difference rarely exceeds 1 per cent. In these trials the instruments have been fixed on at random without any definite relation to the position of the propeller blades, and the number of observations which has been made is such that in all probability any cause of variation of torque which is of at all frequent occurrence would before now have been detected. There is, of course, still the possibility of occasional disturbance in consequence of resonance, but the cause of this would probably be promptly recognised, because it would occur only at one particular speed.

SOME CONSIDERATIONS REGARDING THE PHENOMENA OF PROPULSION.

By Professor J. B. Henderson, D.Sc., Associate.

When a body is propelled through a medium, as in the case of a ship through water, or an aeroplane or airship through the air, the thrust or propelling force is obtained by projecting a stream of the medium sternwards ; and the thrust is equal to the increase in the flux of momentum in this stream as it passes through the propeller. Let us first consider the case of jet propulsion. Suppose we have a pipe A B (Fig. 1) immersed in a perfect fluid, and that A B contains in its length a centrifugal pump or other impeller, which is diagrammatically represented by the screw C. If the screw C is actuated, a circulation is established through the pipe, and the fluid returns from B to A in stream lines outside the tube. The lines of flow would correspond exactly with the lines of force between the two poles of a bar magnet having the dimensions of A B, if magnetized axially so that the poles are all at the ends. It is, of course, impossible to magnetize such a magnet linearly.

If we assume no losses in the pipe and pump, the circulation once established will require no power to maintain it, since there is no loss of energy in the stream-line motion of a

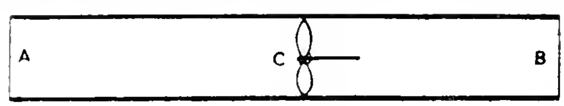


Fig. 1.

perfect fluid, and the impeller may then be dispensed with. The flux of momentum entering at A is equal to the flux leaving at B, and there is therefore, no thrust on the mechanism.

If the orifice at B be contracted, the flux of momentum leaving the tube will exceed the flux entering, but there will still be no thrust on the mechanism as a whole, because the fluid will still flow in stream lines, and the increase in the flux of momentum will be balanced by the difference of pressure on the outside and inside of the contracted end B.

If the whole tube be now moved axially at a uniform speed through the medium in the direction B A, there will still be no thrust, because the fluid motion will still be in stream lines, the new stream lines corresponding to a combination of the old lines with a uniform parallel flow having the given speed. The fluid which has left the tube at B will no longer all return to enter at A, but will mostly spread out behind B in a fan shaped wake, the map of the stream lines corresponding to the map of the magnetic field when a bar magnet or bar of soft iron A B is placed in a uniform magnetic

* Read at the Spring Meetings of the Fifty-first Session of the Institution of Naval Architects, March 17, 1910.

field whose direction is also A B. Since a bar magnet in a uniform field is subjected to no resultant force in the direction of its length, neither will the tube A B be subjected to any resultant thrust.

In order to produce a thrust on the tube as a whole, it is necessary to introduce a discontinuity in the kinematic chain which links the fluid in the tube with that surrounding the tube. Such discontinuity evidently cannot be introduced at the inlet end and must therefore occur at or near the outlet. It may be produced by raising the outlet above the surface of the propelling medium, or it may be introduced by the medium itself not having the properties of a perfect fluid. Both methods are adopted in different classes of propellers. Let us now consider the former method.

Let C (Fig. 2) represent a centrifugal pump raised above the surface of the fluid, the inlet A being immersed in the fluid and the outlet B being above the surface level. The outlet is now disconnected from the rest of the fluid, and, by making the diameter at B less than the inlet diameter at A, we can impart energy to the fluid while it passes through the pump and obtain a thrust on the pump as a whole. The phenomena which would occur in the body of the fluid between the region where the jet strikes the surface and the inlet A are difficult to imagine in the case of a perfect fluid; but in an actual fluid we know that there will be a region of violent eddy motion where the jet strikes the surface, and that from this region to the inlet A there will be a general drift in rough stream-line form, somewhat similar to the stream-line form occurring in a perfect fluid between a source and a sink. As a proof of this last statement we have to consider that a perfect fluid differs from an actual fluid only in having no viscosity and in being incompressible. Energy, therefore, cannot be consumed in eddies in a perfect fluid, and, in fact, it is impossible to form eddies in it. All fluids are compressible, and when a disturbance takes place at one point it is propagated through the fluid with the velocity of sound. But in practice the velocity of sound is very great compared with any velocities occurring in the propulsion problem (except in the case of projectiles); and at points distant from the immediate centre of disturbance the rate of shear is negligible and the viscosity plays little part. Hence at points distant from the immediate centre of disturbance the motions in a perfect and in a practical fluid must be approximately alike.

If the pump moves forward in the direction of the thrust, the fluid motion up to the inlet A will be in stream lines, just as in a perfect fluid when B is submerged. In the region where the jet strikes the surface there will be violent eddy motion, but from this region the fluid will spread out in a wake, corresponding roughly to the stream-line wake when B is submerged in a perfect fluid. This wake would be visible on account of the air bubbles in it which are entrapped in the jet.

IDEAL JET PROPELLER.

In considering the efficiency of any propeller, it is desirable to have a standard of maximum efficiency with which to compare it. We have seen that a jet propeller in a perfect fluid with submerged inlet and outlet would have no losses, and therefore 100 per cent. efficiency, but that it would give no thrust. In order to get thrust, energy must be imparted to the jet, a portion of which must be lost, being finally converted into heat in the wake; hence, if we are to have thrust, we cannot have unit efficiency. But since energy cannot be converted into heat by eddy motion in a perfect fluid, we cannot consider our ideal propeller as simply one working in a perfect fluid, but discharging the jet above the surface of the fluid. There must be introduced, where the jet strikes the surface, some means of consuming the kinetic energy left in the jet and dissipating it in heat in the fluid. Our ideal jet propeller and fluid have therefore all the attributes of perfection until we reach the region where the jet strikes the surface, and there we have the properties of an actual fluid.

Let—

V = the speed of advance of the propeller,
v_o = the speed of the jet at the outlet, relative to the propeller,
v_i = the speed of the fluid at the inlet, relative to the propeller,
F = the mass flux through the propeller,

then,

the thrust $= F\ (v_o - v_i)$,
the useful power $= F\ (v_o - v_i)\ V$,
the total power = the flux of kinetic energy into the jet $= \frac{1}{2}\ F\ (v_o^2 - v_i^2)$.

Hence the efficiency is given by—

$$\eta = \frac{(v_o - v_i)\ V}{\frac{1}{2}\ (v_o^2 - v_i^2)} = \frac{2\ V}{v_o + v}$$

But, instead of dealing with velocities, we are accustomed in propulsion to deal with slip. Calling v — V the *nominal* slip, the *nominal* slip ratio is—

$$s_n = \frac{v_o - V}{v_o}$$

and calling $v_o - v_i$ the *actual* slip, the actual slip ratio is—

$$s_a = \frac{v_o - v_i}{v_o}$$

The nominal slip is the one we are accustomed to use; it would be the actual slip if the fluid ahead of the propeller were not accelerated so as to flow to meet the propeller. We deduce $V = v_o\ (1 - s\ )$ and $v_i = v_o\ (1 - s_a)$. whence—

$$\eta = \frac{1 - s_n}{1 - \frac{s_a}{2}}$$

A similar expression has been proposed by Assistant Naval Constructor Wm. MacEntee, of the United States Navy, for the efficiency of an ideal propeller, but his expression has s_n in both numerator and denominator and therefore neglects the acceleration of the fluid ahead of the propeller. Since s_a is less than s_n the above expression gives an efficiency less than Mr. MacEntee's, but of course the thrust is also less.

In a jet propeller the sectional areas of outlet and inlet are definitely known, hence, denoting these by a_o and a_i, we have $a_o\, v_o = a_i\ v_i$, whence we obtain v_i and—

$$s_a = \frac{v_o - v_i}{v_o} = \left(1 - \frac{a_o}{a_i}\right)$$

$$\therefore\ \eta = \frac{2\ (1 - s_n)\ a_i}{a_o + a_i}$$

We have neglected in the above the difference of levels of the inlet and outlet, and also, in the useful thrust, we have neglected the difference in the pressures on the inlet area at A, and on the corresponding area on the outside of the inlet bend at D, due to the different stream-line conditions prevailing at these two points; but, since the dimensions and form of the propeller are arbitrary we can, theoretically at least, make the inlet and outlet on the same level at the two ends of a straight tube (as in Fig. 1) and have the pressures equal at the two ends.

SCREW PROPULSION.

Suppose now that the tube in a submerged jet propeller is made quite short, then, so long as there is continuity, the stream-line distribution round it will be that due to the source and sink combination formed by the inlet and outlet. When these come very close together, the combination is called in hydrodynamics a plate doublet, and the stream-line distribution due to a plate doublet is a free vortex. A free vortex cannot be generated in a perfect fluid, but it is comparatively easy to generate one in viscous fluids, a smoke ring in air being a good example. The stream lines in a free vortex can be most easily studded experimentally in the electro-magnetic analogue—a magnetic shell, which is readily produced by a single turn of wire, or a ring coil carrying an electric current. The magnetic field round the coil is easily explored by iron filings, and the calculated form of the lines is given in Lord Kelvin's papers on Vortex Motion (R. S. Edin., 1869, also Collected Papers, vol. 3, p. 432), and in Maxwell's Electricity and Magnetism (Vol. II., Plates, Fig. 18).

If a screw propeller actually generated a free vortex in the fluid in which it works it would exert no thrust, and the propeller and vortex would advance together through the fluid. The thrust obtained from a screw must be due to a discontinuity in the stream-line motion and this discontinuity is probably entirely confined to the wake. We have experimental evidence (as we shall see later) that it is present in

the wake, the wake contracting behind the screw, and then, at a short distance from the screw, expending its energy in mixing with the surrounding fluid in a region of violent eddy motion. So far as distant points of the fluid are concerned, this discontinuity simply corresponds to a small separation of the source and sink; hence the stream-line motion at distant points will differ very slightly from that obtained by combining a free vortex with a parallel flow, or a magnetic shell with a uniform field. The writer has employed this method for illustrating the flow up to propellers by using a zinc cylinder 1 ft. diameter, wound with wire over a length of 4 ft., for the purpose of generating a uniform field

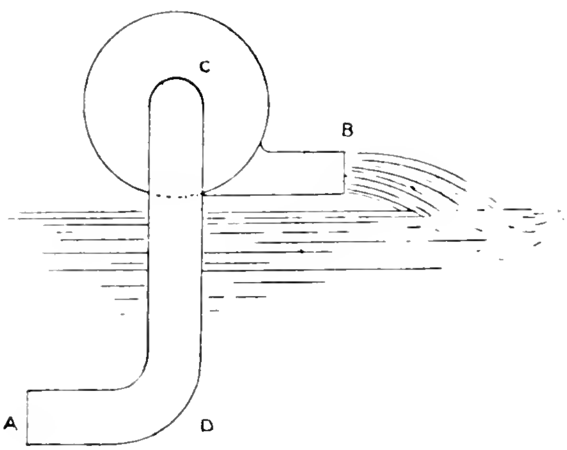


Fig. 2.

inside the cylinder. In this uniform magnetic field the little ring coils to represent the propellers are placed, and the field round the propellers is mapped out by iron filings sprinkled on a board. If the current in either the helix or the ring coils is varied, the effect of different slips may be studied. A still closer approximation to the stream lines near the propeller might be obtained by winding small cylinders to represent the propellers instead of ring coils, thus allowing for the distance between the source and sink caused by the discontinuity in the wake.

If the stream lines up to twin screws working near the surface are wanted, it is necessary to place four ring coils in the tube, two to represent the screws and two to represent

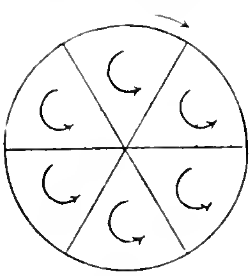


Fig. 3.

their images in the surface of the water. By this means the surface is made a stream surface.

This analogy between hydrodynamic and electro-magnetic problems is a very useful one. For instance, we know that the magnetic field due to a short magnet, at points distant three or four times the length of the magnet, is independent of the shape of the poles or of the distribution of magnetism on them; hence from analogy we deduce that the stream lines due to a screw propeller must be independent of the number or shape of the blades, at all points which are distant three or four times the distance between source and sink. We shall see later that this distance is at least equal to two or three diameters of the screw. The electro-magnetic equivalent of a one-bladed screw would be the revolution of a small electrically charged sphere round an axis at a distance equal to the radius of the screw. These analogies, however, must not be driven too far.

From the different stream-line conditions prevailing round a screw and round a rectilinearly moving plate we conclude that it is impossible to deduce any information regarding the behaviour of screws from the rectilinear motion of plates through water.

There can be no large amount of rotation in the fluid ahead of the propeller; for, if we consider the rotational component motion which would be produced on any particle by the motion of one blade when in two diametrically opposite positions, we see that these rotations would be of opposite signs, while in all positions of the blade the impulses received by the particle from the blade tend to accelerate it towards the screw. We realize, of course, that a flux of momentum must be imparted to the whole fluid equal to the torque, but the magnitude and distribution of this rotation is by no means simple. Suppose we take a bowl of water and divide it into compartments by radial partitions (Fig. 3) and then rotate the bowl about the vertical axis, say in the clockwise direction, the water in each compartment flows round the compartment in the counter-clockwise direction, and only after the lapse of considerable time can we get the water to rotate with the bowl. Hence, even if the fluid on which a screw operates were confined to that which passes through the screw disc, the distribution of the rotation in the wake would be by no means simple. But the fluid affected is not so restricted unless the screw is encased.

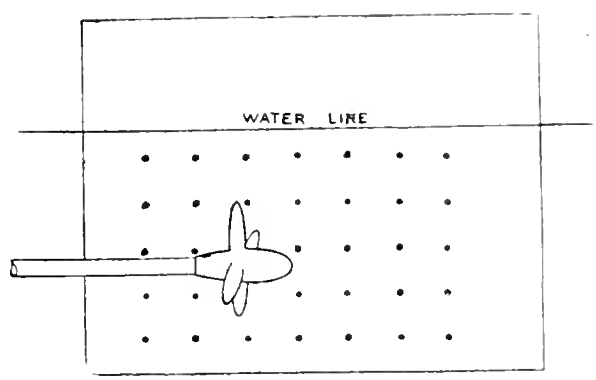


Fig. 4.

In the two-dimensional problem of the rotation of an elliptic cylinder in a perfect fluid, the distribution of the angular momentum in the fluid can be calculated. In the region intersected by a prolongation of the minor axis of the ellipse, the angular momentum is in the same direction as that of the solid cylinder; but in the region intersected by a prolongation of the major axis it is in the opposite direction, and there is a definite surface separating the two regions of opposite angular momenta. If the angular momentum be integrated throughout the whole fluid and also throughout the co-axial circular cylinder whose diameter is equal to the major axis, the two integrals are equal, showing that in this case we may consider the angular momentum as entirely confined within the "disc area."

Again, if we consider a circular cylindrical surface co-axial with a screw propeller and surrounding it in a region of continuous motion, we see that any angular momentum imparted to the fluid outside the cylinder must be transmitted across the cylindrical surface by viscosity, and could therefore have no great magnitude. Since the region of continuous motion comes quite close up to the screw, there is every probability that the angular momentum imparted to a fluid by a screw is confined to the region of fluid in the immediate neighbourhood of the screw. In the absence of any theoretical or experimental knowledge of the distribution of this angular momentum, we cannot allow for it in the expression for the efficiency of an ideal screw.

The phenomena in the wake are best illustrated by the experiments of Naval Constructor D. W. Taylor, of the United States Navy, on the distribution of pressure near the screw, and also by the stereoscopic photographs of a model advancing through a small tank recently published by Geheimer Regierungs Rath Professor Oswald Flamm. Figure 5 shows one of the illustrations in Professor Flamm's publication, which is reproduced here by his kind permission. The tank has glass sides and the plate shows instantaneous stereoscopic photographs of the screw taken through the glass side while illuminated by the beam from a large arc-light projector. The screw is rotating at a high speed and air is being sucked down from the surface. On leaving the blade near the tip the air shows clearly the spiral path traced by the blade through the wake. It will be noticed that the wake, as outlined by the spiral, maintains approximately a cylindrical form for a distance of 2 or 3 diameters behind the screw, and that beyond this point eddy motion is in strong evidence. This wake may be interpreted as follows :—

The flow up to the screw disc has been continuous and approximately in stream-line form, but on passing through the disc the portion immediately acted on by the screw is accelerated relatively to the surrounding fluid. It becomes discontinuous with the surrounding fluid, and is projected sternwards as a jet, the surface of discontinuity being a seat of eddies. After the jet has progressed by a distance of two or three diameters from the screw disc, these eddies begin to enter the body of the jet, and the whole jet is soon linked up again with the surrounding fluid in a region of violent eddy motion.

If this explanation is correct, there ought to be a contraction in the jet in the immediate neighbourhood of the screw. We have no means of accurately testing this point in the photographs ; but, if we assume that the air leaves at or near the tip of the blade, we find that the diameter of the air spiral is in every case less than the diameter of the screw, being about one-ninth smaller in the second photograph. The diameter of the air spirals also apparently contracts along the jet ; and, if this represents a real contraction of the jet, the pitch of the spiral should increase correspondingly, the percentage increase of pitch being twice the percentage decrease of diameter. Careful measurements of the spirals fail to show any marked increase of pitch, but the photographs are badly adapted to such measurements, since they show a perspective view of the phenomena, and air is a notoriously bad indicator of the motion of water, since the difference of densities accelerates the air to the points of minimum pressure. Hence any acceleration in the wake would cause the air spiral to move forward through the wake, and any rotation of the wake would cause the diameter of the spiral to decrease.

Before we can consider the action of a screw as that of a type of simple jet propeller, we must study the pressure distribution round the screw. Professor Flamm's photographs show that there is a depression of the surface over the screw, but no change of surface level on passing the screw disc, hence there is no sudden change of pressure on passing the disc, at least above the screw. Mr. D. W. Taylor has carried out some experiments on this point in connection with the influence of the screw on the pressures on the ship's stern plating, or what is called the thrust deduction factor. (Model Basin Gleanings, Proc. Amer. Soc. N.A., Nov., 1906.)

In these experiments a vertical board was placed in the experimental tank parallel to the axis of the screw as shown in Fig. 4. A row of holes was made in the board about the level of the screw shaft, and similar rows at higher and lower levels. Each hole was connected to a separate manometer, and the various levels of the manometers were recorded by shutting a stopcock on each as the board advanced through the water with the screw. The results obtained show a minimum pressure about 6 in. in front of the screw, and a maximum about 6 in. behind it, the screw diameter being 15 in. When the board was only ¾ in. from the tip of the screw blades the difference between maximum and minimum was about 5 in. of water with 30 per cent. nominal slip, but when the board was 12 in. from the blade tips the difference died away to less than ½ in. It is evident that placing a board near the screw must materially affect the free flow up to the screw, and also the distribution of rotation round the screw. Hence from our point of view the results are not so instructive as they might have been if a light wire trellis had been used instead of a board to support the pressure tubes. But, of course, our object and Mr. Taylor's are different.

In a source and sink combination we expect to get a rise of pressure in passing by the side of the sink, or a fall in passing the source, and Mr. Taylor's experiments verify that the screw disc plays the part of a sink. The source is, of course, the region of eddies where the jet becomes linked up with the surrounding medium. Neither in Professor Flamm's photographs, nor in Mr. Taylor's results, is there any contradiction of the hypothesis that a screw propeller is a type of simple jet propeller, in fact all the evidence supports the hypothesis.

We have seen that the ideal efficiency of a jet propeller is—

$$\eta = \frac{1 - s_n}{1 - s_a/2}$$

in which s_a and s_n are defined from the velocity of the jet, the nominal slip being the velocity of the jet relatively to the whole body of the fluid, while the actual slip is the change of velocity in passing through the propeller. Let us now discuss these velocities for an ideal screw propeller.

We may consider the ideal screw propeller as one which acts equally on every particle of fluid passing through it, in such a manner that the whole column of fluid leaves the disc without rotation, with the velocity which a solid nut would have if driven sternwards without rotation by the driving face of the screw. Actual screws differ from the ideal in that the blades do not act equally on all particles in the jet, hence the mean velocity of the jet is less than the solid nut velocity, thus reducing the thrust below the ideal. Actual screws also impart a certain amount of rotation to the wake, but we could not allow for this in the expression for the efficiency of an ideal screw, even if we desired to do so. In fact, that is one of the reasons for the failure of some of the formulæ which have been suggested for the ideal screw, in that they allow for a certain distribution of rotation which does not exist. The discussion of other formulæ would, however, require a paper to itself. The double co-axial screws used in torpedoes constitute a propeller which gives no rotation to the wake, and, if the rotation produced by a single screw were great, this combination ought to be much more efficient than a single screw.

Let R be the revolution frequency of an ideal screw and P the pitch, then

$$v_o = \mathrm{R\,P} \text{ and } s_n = \frac{(\mathrm{R\,P} - \mathrm{V})}{\mathrm{R\,P}},$$

while—

$$s_a = \frac{(\mathrm{R\,P} - v_1)}{\mathrm{R\,P}}.$$

The thrust obtained from the ideal screw is given by

$$\mathrm{T} = \mathrm{F}\,(\mathrm{R\,P} - v_1) = \rho\, a\, v_1\,(\mathrm{R\,P} - v_1) = \rho\, a\, \mathrm{R}^2\,\mathrm{P}^2\, s_a\,(1 - s_a) = \frac{\pi}{4}\,\rho\,\mathrm{D}^2\,\mathrm{V}^2\,\frac{s_a\,(1 - s_a)}{(1 - s_n)^2},$$

a being the area of the screw disc and ρ the density of the fluid. Hence for an ideal screw of given pitch v_1 and s_a are known as functions of the thrust and revolution frequency.

It is unfortunate that we have no experimental information upon the connection between the thrust and the velocity v_1, such as could be obtained by inserting a Pitot tube immediately in front of the screw in tank experiments. The manometer readings would give directly the value of v_1, which would enable us to determine s_a as a function of s_n.

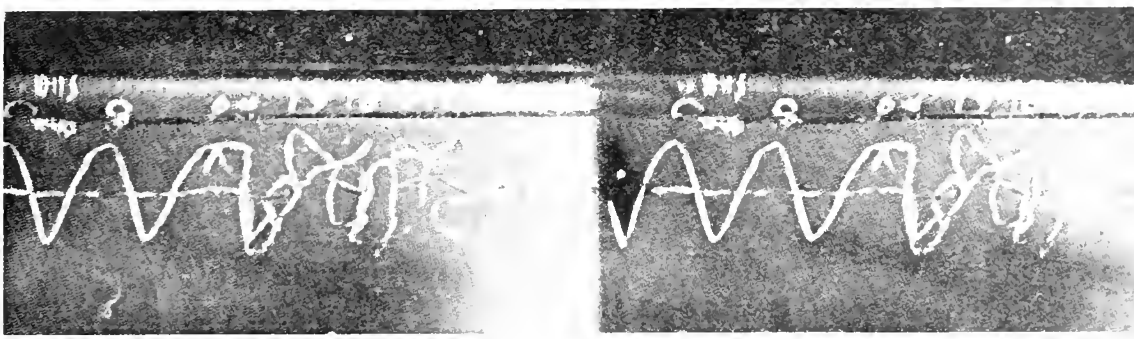
The expression for the thrust of an actual screw given by Mr. R. E. Froude from the results of his tank experiments is—

$$\mathrm{T} = \mathrm{D}^2\,\mathrm{V}^2 \times \mathrm{B}\,\frac{p + 21}{p} \times \frac{1{\cdot}02\ \mathrm{S}\,(1 - {\cdot}08\ \mathrm{S})}{(1 - \mathrm{S})^2}$$

which bears a strong resemblance to our ideal screw formula. The S in Mr. Froude's formula is practically our s_n. The factors B, $\frac{p + 21}{p}$ and $(1 - {\cdot}08\ \mathrm{S})$ are purely empirical, and the only difference between the form of the theoretical portion of Mr. Froude's formula and the ideal one is the omission in the former of the factor $1 - s_a$; but, in order to make his formula suit the experimental results, Mr. Froude had to introduce the factor $1 - {\cdot}08$ S, and this fact tends to support the theoretical form of our formula. Again, taking one of Mr. Froude's experimental results, a screw 0·8 ft. diameter, of pitch ratio 1·2, disc area ratio 0·45, with four elliptic

Fig. 5

V = 2·8 m/sec R = 2500 W = 0



V = 2·4 m/sec R = 2500 W = 4 kg

V = 3·5 m/sec R = 3200 W

V = 3·5 m/sec R = 3200 W

blades, when running with 30 per cent. slip at 300 ft. per minute, exerts a thrust of 8 lbs. weight. Substituting this thrust in our formula and calculating s_a, we find it is 20 per cent., which is quite a possible value. A further comparison of the two formulæ would serve no useful purpose until we have some experimental evidence of the connection between s_1 and s_2; but, so far as we can at present see, there is nothing in Mr. Froude's results which contradicts our formula—in fact, the evidence is rather favourable than otherwise.

In Professor Flamm's photographs, if we neglect the unknown drift of the air spirals through the wake, we can deduce from them the speed of the wake and compare it with that from an ideal screw. Taking the second photograph in fig. 5, we find by measurement that the pitch of the air spiral is equal to its diameter—

$$=\frac{17}{19}\cdot\text{diameter of the screw}=\frac{17}{19}\times 10\text{ cm.}=8{\cdot}95\text{ cm.}$$

The frequency of revolution is 2,500 per minute, whence we obtain the speed of the wake as 3·73 metres per second. But the actual pitch of the screw is 10·25 cm., whence the speed of the wake from the ideal screw having the same pitch and frequency is 4·27 metres per second.

If we assume for the purposes of a numerical example that the air leaves the tips of the blades, then—

$$v_1=\left(\frac{17}{19}\right)^2\times 3{\cdot}73=2{\cdot}99\text{ metres per second.}$$

The speed of the screw was 2·4 metres per second. Whence—

$$s=\frac{(3{\cdot}73-2{\cdot}4)}{3{\cdot}73}=0{\cdot}375.$$

while—

$$s_1=\frac{(3{\cdot}73-2{\cdot}99)}{3{\cdot}73}=0{\cdot}199.$$

Therefore, the efficiency of an ideal screw which gives the same thrust in the same conditions is

$$\eta=\frac{(1-0{\cdot}375)}{(1-0{\cdot}199)}=71{\cdot}4\text{ per cent.}$$

The mass flux through the screw $=\rho\, a\, v_1=23{\cdot}5$ kilogrammes per second, whence the thrust

$$=\frac{23{\cdot}5\,(373-299)}{981}=1{\cdot}77\text{ kilogrammes weight.}$$

All we know about the actual thrust is that the little carriage carrying the screw raised the weight of 4 kilogrammes through one-third the travel of the screw by means of a pulley block, hence the thrust was at least 1·33 kilogrammes weight.

Again, if we assume that the screw was an ideal one, moving with the same speed, and that the water approached it with the same speed 2·99 metres per second—but left it with the speed R P =4·27 metres per second, then the thrust

$$=\frac{23{\cdot}5\,(427-299)}{981}=3{\cdot}01\text{ kilogrammes weight,}$$

and the efficiency is 66·1 per cent.

We have seen, however, that the air spirals are very bad indicators of the motion of the wake, consequently we can attach no great weight to these figures; but similar experiments with a coloured liquid as indicator would provide valuable information.

Law of Comparisons.

If the stream-tube system due to a source and sink combination in a perfect fluid is to have its dimensions magnified n times, the velocity and pressure heads at homologous points in the two systems must be in the ratio $n:1$, that is, the velocities are in the ratio $\sqrt{n}:1$, and the pressures are in the ratio $n:1$. The areas of the source and sink are in the ratio $n^2:1$, hence the mass fluxes are in the ratio $n^{2\cdot5}:1$, and the momentum fluxes in the ratio $n^3:1$.

Two similar screw propellers whose diameters are in the ratio of $n:1$ will produce similar stream-tube systems around them, if moving forward at speeds in the ratio $\sqrt{n}:1$ while rotating with peripheral speeds in the ratio $\sqrt{n}:1$, *i.e.*, with revolution frequencies in the ratio $1:\sqrt{n}$, provided that the distance between the equivalent source and sink increases in the ratio of $n:1$. The thrusts will then be in the ratio $n^3:1$. Now the equivalent source, on our hypothesis, is the region where the screw jet expends its energy in mixing with the surrounding fluid, and is therefore of a very indefinite nature. The sink, on the other hand, is the advancing face of the screw disc and is perfectly definite. But if the distance between source and sink is only roughly proportional to the diameter of the screw at corresponding speeds, then similar results may be expected from similar screws, since it is the stream tubes up to the screw which affect its working and the flow in the wake is only important in so far as it affects the flow up to the screw. But unless the source and sink are very close together the flow up to the sink is very slightly affected by a small increase in the distance between them, or by an alteration in the shape of the source.

Since the authorities in charge of experimental tanks tell us that the law of comparison is found experimentally to apply to screws with sufficient accuracy for practical purposes, we deduce the fact that the deviation from similarity in the position and form of the source due to variation of linear dimensions is not of sufficient importance to affect materially the flow up to the screw.

If we knew the connection between the actual and nominal slips which a Pitot tube inserted near the screw would give us, then, by combining this information with the extensive experimental results which we have on thrust and efficiency as functions of the nominal slip, we could test our hypothesis, and we would probably obtain still further insight into the phenomena of propulsion.

Conclusions.

We may summarise the chief points of the analysis of the phenomena of propulsion as follows:—

(1) A propeller forms the centre of a system of stream tubes, the configuration of which moves forward with the propeller. In a perfect fluid the system consumes no energy, but in a viscous fluid the energy required for its maintenance is supplied by the propeller.

(2) In a perfect fluid—and also in a viscous fluid, apart from the small thrust required to maintain the stream-line system—thrust would be impossible of attainment without a discontinuity in the stream-tube system. In a jet propeller this discontinuity occurs at the outlet and in a screw propeller most probably in the wake, beginning at the screw disc.

(3) The acceleration of the fluid ahead of the propeller does not contribute to the thrust, but is brought about by a circulation of energy from the wake, as in a moving source and sink combination; hence all the energy in the wake as it leaves the propeller is not lost. The thrust produced by a screw propeller is due to an acceleration of the whole or part of the fluid as it passes through the screw disc, the accelerated portion being discontinuous with the surrounding fluid, thus forming a jet.

(4) In the case of a screw propeller there must be a flux of rotational momentum into the surrounding fluid equal to the torque. This rotational momentum is most probably confined to the immediate wake behind the screw, and the screw is continuously imparting rotational velocity to new fluid, this rotational energy constituting one of the losses in the propeller. Since this rotational system, unlike the stream-tube system in the fore and aft direction, cannot move forward with the screw unchanged, the rotational motion is not cumulative.

(5) All the experimental evidence examined tends to confirm the working hypotheses formed from purely theoretical considerations, but further experiments are wanted on the distribution of velocity both ahead and astern of screw propellers to determine the connection between nominal and actual slip.

In conclusion, I desire to express my cordial thanks to my friend and colleague Professor Wm. Burnside, F.R.S., for his valuable advice and criticism; also to Geheimer Regierungs Rath Professor Oswald Flamm for his kind permission to reproduce Fig. 5.

Japan-British Exhibition.—It is rumoured there is to be a magnificent reproduction of the great Daibutsu of Kamakura at the Japan-British Exhibition. This, of course, will be on a reduced scale, for the original model of the god Amida, which dates from A.D. 1252, is 49 ft. 7 ins. high, 97 ft. in circumference, has a face 6 ft. 5 ins. long, and a central golden eye 3 ft. 11 ins. across. Presumably, it was first made in sections and then placed together, a most remarkable thing about this part of the work being that a great British engineer recently declared modern science to be unable to get the wonderful welding results which the Japanese of those far-off days obtained.

WHITE STAR LINERS "OLYMPIC" AND "TITANIC."

NOW that the excitement of the General Election has subsided, these mammoth vessels are again objects of public interest, and the patriot may well be excused a sense of pride by a reflection on the pre-eminence of British shipping, not only as regards the total tonnage as compared with the rest of the world, but by the construction of these two vessels, unapproached as they will be for their size and luxurious appointments.

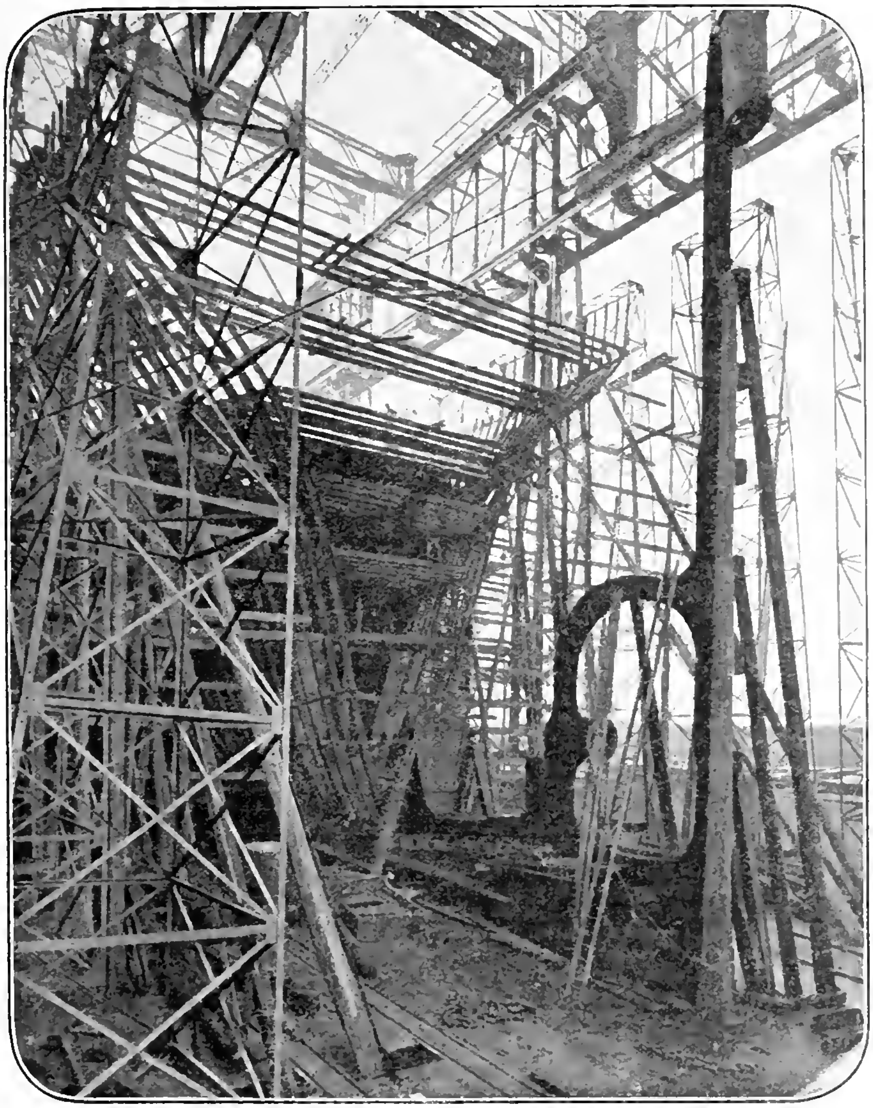


Illustration showing progress of work on the *Titanic*.

The *Olympic* is making remarkable progress, and although such unique structures must necessarily require long periods for the execution of the work at the various stages of construction, so complete is the organization of the builders that it is understood the launching date is already fixed to take place on the 20th of October next. The vessel is already more than half-plated and riveted, and on a view of the hull we had a very true impression of the progress that has been made, as the internal work of construction has also proceeded rapidly and simultaneously. Several of the principal decks, such as lower, middle, upper and saloon decks, are already plated, and the plating of other decks is proceeding, also the construction of the partitions and houses on some of the decks. The engine and boiler casings are well advanced, also the engine seating.

The work at the *Titanic* is also proceeding apace, the stern frame being now in position, and the construction of these two vessels side by side, the two representing something like 120,000 tons displacement, is a record in shipbuilding which speaks volumes for the enterprise of the White Star Line. It also affords evidence of the development of commerce and intercourse between the two hemispheres. Rudyard Kipling's latest speculations on the conquest of the air may or may not be realized wholly or in part next century. There is no need to speculate with regard to the doings of the White Star Line; their enterprise has not only secured to Atlantic travellers ideal conditions for crossing the ocean in the present century, but has also ensured the continued supremacy of British shipping.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From Our Own Correspondent.*)

Portsmouth Dockyard.

THE new battleship we have been allotted—"New armoured ship No. 1," as she is designated in the Estimates—will not be commenced until very late in the year, as anticipated last month, only £96,714 being allowed for her. As to the shipbuilding in hand, £503,686 has been put down for the battleship *Neptune*, which will be commissioned before the end of the financial year, and £983,457 for the *Orion*. The wages on the three vessels will amount to over £290,000. With regard to refits, we are fairly well provided for to the extent of £82,000 in wages. The cruiser *Good Hope*, which is in hand, is to have £66,055 expended on her, and the other vessels to come in during the year are:—The cruiser *Drake*, £24,219; the cruiser *Argonaut*, £47,798; and the cruiser *Mercury*, which is now used as a submarine depot ship, and is to be fitted as a hulk for accommodating the crews of submarines at a cost of £5,322; but probably that amount is only a portion of the total cost. The battleship *St. Vincent*, although she is not to hoist the flag of Admiral Sir William May, is to be a flagship after all, and she will be commissioned probably the last day in March to relieve the *Lord Nelson* as flagship of Rear Admiral Sturdee, the second in command of the First Division of the Home Fleet. The vessel attained a speed of 20·9 knots on her full power trials, developing 25,900 shaft horse power, the coal consumption being only 1·48 lb. per shaft horse power per hour. The battleship *Dreadnought* came in at the beginning of the month for a somewhat extensive overhaul, which will occupy until the middle of April. It was quite unexpected, as no provision was made in the Estimates for such a refit. Admiral May's flagship has been in commission for nearly three and a half years, and it speaks well for the workmanship of this yard that she has not given any cause of complaint. Both the Royal yachts have completed their annual overhaul. In the *Victoria and Albert* the royal apartments have been renovated, as it is understood that their Majesties contemplate a trip up the Mediterranean in the spring. The *Alexandra* was used to convey the King from Dover to Calais early in March. The battleship *Renown*, about which questions have been asked in Parliament, is now doing duty at this port as a training ship for stokers. Her secondary armament has never been replaced since she was fitted for the voyage of the Prince and Princess of Wales to India, and she cannot therefore be regarded as an effective ship. The cruiser *Nelson*, the late training ship for stokers, is to be placed on the sale list. The new ocean-going destroyer *Swift*, of the First Flotilla, received some slight damage to her plates on March 7th through a collision in the Solent with a gunboat, but it was not necessary to dock her. Another collision occurred early on the morning of March 10th, when the Isle of Wight steamer *Princess Margaret*, going out from the harbour railway pier to turn, collided in the darkness with the destroyer *Crane*, which was secured to a buoy. The *Crane's* bows were badly damaged and she began to ship water, but her pumps kept her clear until daylight, when she was placed in dry dock. It is announced that Admiral Sir Assheton Curzon-Howe will take the command at Portsmouth when Sir Arthur Fanshawe leaves on his promotion to Admiral of the Fleet on April 30th.

Devonport Dockyard.

The Navy Estimates have been looked forward to with interest in political circles, but with nothing like the interest that those in the dockyard towns look forward to them. As was generally anticipated, Devonport is to have an armoured ship—"No. 2"—though whether a battleship or an armoured cruiser is not known. She will not be laid down until after the *Lion* is launched, which will probably be in July, and the amount allowed for her construction in the new financial year is £96,723, which is £14 more than that allowed for Portsmouth's new vessel. The Estimates allow £20,035 for contract work on the battleship *Collingwood*. It was intended to commission the vessel by the end of March, but she will not hoist the pennant until a week or two later. The delay is due to the work which has been necessary with the under-water fittings to obviate ashes from the ejectors choking the water inlets connected with the condensing machinery. To overcome this the relative positions of these fittings are being altered. It is a pity, from a sentimental point of view, that she could not have been ready for commissioning by March 7th, which was the centenary of the death of the famous Admiral whose name she perpetuates. The battleship *St. Vincent*, which was commissioned on March 1st for the First Division of the Home Fleet, is having her ash ejectors similarly altered. The cruiser *Lion* by the end of March will have been seventeen weeks under construction, and at the rate she is progressing will by that time have been advanced to nearly fifty per cent. of her launching weight. The amount allowed for the *Lion* in the coming year is £1,123,387, £178,685 of which is for labour. For the cruiser *Indefatigable*, which will be commissioned before the end of the financial year, £511,399 is put down, £125,385 being for labour, and this will make the total amount spent on that vessel £1,416,976. The number of refits is about the usual. A further £32,568 is allowed for the cruiser *Highflyer*, which, as announced last month, is undergoing a most extensive overhaul, and the cruiser *Pelorus* and the torpedo-gunboat *Hebe* a further £3,908 and £4,607 respectively. The vessels to come in for refit during the year and the amounts allowed for them are:—The cruisers *Amphitrite*, £33,246; *Europa*, £19,822; *Arrogant*, £8,158; and *Talbot*, £8,804. The wages bill for the refits will amount to close on £63,000. The cruiser *Niobe*, which is temporarily acting as flagship of the local division of the Home Fleet, on returning from the spring cruise is to be taken in hand for a refit and to have her equipment modernized in order to fit her for service as a training ship for Canada, by whom she is about to be purchased. The *Niobe* was built by Messrs. Vickers at Barrow in 1897-99. The armoured cruiser *Defence* has left on the completion of her refit, but the *Warrior* is still here. The foremost funnels of the vessels of those two classes are to be lengthened by about ten feet. The shortness of the funnels was commented on in these columns at the time the vessels were first commissioned. The alterations to the *Warrior* will be made while she is in dockyard hands. The destroyer *Gipsy* has been taken in hand for a refit and a vessel of the Second Destroyer Flotilla—the *Liffey*—is also undergoing repair, an examination of her underwater fittings having disclosed defects in the port propeller, the blades being bent. Two vessels which were recently in the local destroyer flotilla, the *Starfish* and *Sturgeon*, have been removed from the effective list, as it is considered that they were not worth the expense of repair.

Chatham Dockyard.

The over-sanguine ones, who confidently expected a vessel of the *Dreadnought* class, are possibly disappointed, but the majority here are quite satisfied that we are once again to build a vessel larger than a tug or a submarine, the class of work we have been engaged on since the *Shannon* was built. The new vessel is described in the Estimates as "Unarmoured Cruiser No. 1," but only £53,690 is to be spent on her during the coming year, £11,000 of which will be for labour. Still it shows that Chatham has not been forgotten, as many were afraid that we might be. No particulars are available as to the new ship, but she will probably be one of the "City" class. We are also allotted two submarines, for which £13,846 is allowed. Of the seven submarines of the old programme, three have been completed, and "*C* 33" and "*C* 34" are well under way, and when they are completed "*D* 7" and "*D* 8" will be got on with. The first three vessels are to be completed during the year. On these craft £180,403 is to be spent, the total labour bill on submarines amounting to nearly £77,000. From this it will be seen that submarines are to play a large part in Chatham's future. The tugs *Atlas* and *Pilot*, for Hong Kong and Portsmouth respectively, are practically completed, while for the tug *Firm* £24,469 is allowed, and for the tug *Alliance* £23,301, and there is another £18,464 for "Yard Craft No. 94," the steam mooring and salvage lighter referred to last month. With regard to refits, there are the battleship *Irresistible*, of the First Division of the Home Fleet, £74,665; the cruiser *Cressy*, of the Nore Division of the Home Fleet, £48,290; the cruiser *Euryalus*, £65,915; and the cruiser *Dido*, of the

First Division of the Home Fleet, £10,195. The cruiser *Intrepid*, which is being converted into a mine-layer, is to have a further £25,575 expended on her, and the cruiser *Naiad*, which is being similarly converted, another £23,336. The labour on these six vessels is estimated at £150,650. We shall be quite ready for our new work when it comes in. The cruiser *Vindictive* will have completed her refit by March 31st, when she will be commissioned for the Nore Division of the Home Fleet. The cruiser *St. George* was commissioned on March 15th to take the place of the *Tyne* as depot ship of the Nore Destroyer Flotilla. The cruiser *Topaze*, which has been here for the past few weeks, will be ready to rejoin the Portsmouth Flotilla about the middle of April. Her sister vessel, the *Sapphire*, of the Devonport Flotilla, has been taken in hand for her annual refit, which will occupy several weeks. The special service vessel *Hearty*, which was built originally for use as a tug on the River Hooghly, and subsequently purchased by the Admiralty, was for many years employed as senior officer's ship in the fleet protecting the North Sea fisheries. Afterwards she was relieved by the torpedo-gunboat *Halcyon*, and until recently she was used on communication service in the Medway. She is now to be utilized as a surveying vessel, and she has been taken in hand to fit her for that work. The *Ancheron*, which has for some years past been used as a training ship for stokers, is to be converted into a coal hulk, and on April 1st, the men on board are to be transferred to the Naval Barracks. The vessel, which was formerly the cruiser *Northumberland*, was built in 1868.

Sheerness Dockyard.

No one expected that the Estimates would contain anything in the shape of new construction for Sheerness, and therefore nobody was disappointed, for our days of shipbuilding are evidently a thing of the past. The announcement relative to the ordering of a large floating dock to be stationed in the Medway is, of course, of interest, but not financially. Ultimately the dock will be of advantage to us, but not this year. The only particular items of interest to us are those concerning the torpedo gunboats *Harrier* and *Speedy*, which are to be refitted at this yard at a cost respectively of £18,149 and £11,317, the labour bill on the two totalling just over £15,000. Of course, we shall have some share of the £106,878 allotted for the refits of thirteen destroyers, and other work is bound to come, in addition to the periodic docking of torpedo craft and submarines, which is our regular work. The torpedo-gunboat *Hazard* will be out of hand by the end of the financial year (March 31st), and she will then return to Portsmouth to resume her duties as submarine depot ship. The new ocean-going destroyer *Saracen* appears to be an unfortunate vessel. She had been in dock-yard hands since October 22nd, when her bows were badly damaged in collision with a collier in the North Sea, and was completed in January, but had been detained a few weeks for the repair of some defects in her condensers. She left harbour on March 7th, and while steaming at a speed of 33 knots to test the efficiency of the repairs ran aground on the South Shoebury Sands. As the tide had turned an hour before there was no hope of floating the vessel until the flood made. Every precaution for the safety of the destroyer was taken without delay, and the cruiser *Endymion*, which left harbour a few minutes before the *Saracen*, went to her aid. Captain Torlesse, the superintendent of the yard, sent the tug *Grinder*, with an officer of the Chief Constructor's Department, to report on the position of the destroyer, and at the same time another tug with launches was sent to assist in lightening the stranded vessel. The *Saracen* was refloated next day and towed by the *Diligent* into harbour. She was dry docked for examination, but there was no serious damage. A few slight leaks were found.

Pembroke Dockyard.

The publication of the Navy Estimates was awaited with great interest, and everybody was gratified when it became known that Pembroke had been allotted two unarmoured cruisers, "Nos. 2 and 3." Upon the former the sum of £122,823 is to be expended and on the latter £30,217, the labour on the two being put down at £42,000. No details have been made known as to what class the vessels will be, but it is quite likely that they will be of the *Boadicea* class. The cruiser *Blanche*, which was laid down nearly a year ago, has been allocated £90,867, making a total of £279,721, and her sister, the *Blonde*, which was only laid down in December, £153,618, which will make £240,071 in all allowed for that vessel. The labour on the two ships is estimated at over £76,000. There is a probability too, that, although no refits are mentioned in the Estimates as coming to this yard, we shall have some small craft to put right, as we have had in the past year. With regard to the *Blonde*, it has been decided to use the cast-steel sternpost recently referred to in these columns as having been condemned on account of a hole due to an air blow. The casting has been returned to the contractors, Messrs. Breadmore, Glasgow, who will stop the hole by electrical fusion. The casting will then be as good as if the flaw had not existed. The *Blanche* is making headway rapidly and is quite as far advanced as it was expected she would be. She should be in commission about Christmas if all goes well. Two of the three torpedo-boats of the local flotilla, Nos. 041 and 040, are undergoing their annual refits. The boats are lying abreast of each other in dock on new sets of blocks. This is the first time on which two vessels have been dry docked abreast at this yard. The other work in hand consists of the torpedo-gunboat *Antelope* and the torpedo-boat destroyer *Sylvia*, both of which are undergoing a refit. All things considered, Pembroke can look forward to the year 1910-11 as being quite as prosperous as 1909-10.

OBITUARY.

THE LATE MR. JAMES Y. LOWE.

VICE-PRESIDENT,
INSTITUTE OF MARINE ENGINEERS.

THE death of Mr. James Y. Lowe on February 22nd, at the age of fifty-eight, caused very keen regret to a large number of old shipmates and many friends to whom he had endeared himself by the exercise of those good qualities of heart and mind which characterise true manhood ever ready to help

a comrade in trouble, courteous and kindly in his dealings with those he met, and a good and faithful engineer in the discharge of duty. His father held an official position in the town of Dumbarton, where Mr. Lowe was brought up, attending school there with considerable credit at the Burgh Academy and serving his apprenticeship with Messrs. Denny & Co. He may therefore be said to be, and indeed was, on the maternal side, a son of the Rock, in virtue of which he was a member of the London Dumbartonshire Association. He joined the British India Company in October, 1874, and after serving in the various grades to chief engineer on the Indian coast he was transferred to the home line, and served as chief engineer in the *Navarino*, *Rewa* and *Golconda*, joining the latter steamer in November, 1890. He made his last voyage in 1909, at the termination of which, although apparently well on arrival, he was suddenly seized by illness, which rendered it necessary for him to seek rest and medical treatment, with relief from duty. Finding subsequently that he would be unable to resume duty, he retired on a pension granted by the Company, in whose service he had been for over thirty years. While serving as a junior engineer in India, Mr. Lowe fell with a shipmate from the rail of a steamer into the bottom of the dry dock at Bombay, sustaining severe injuries, the effects of which he carried with him to the end. Mr. Lowe was one of the early and deeply-interested members of the Institute of Marine Engineers, and was elected a Vice-President in 1909. He died at Biddenham, near Bedford, and the funeral service was held in Biddenham Church on February 25th, in the graveyard of which his mortal remains were interred, while his memory will long linger amid many circles far and near.

The late Mr. James Pollock.—A figure very well known in engineering circles, which will be missed with poignant regret is that of Mr. James Pollock, who has crossed the dark river after an illness dating back to last August. A man of iron constitution and tremendous vitality, he repeatedly rallied after his medical attendants had given up hope, but at last he sank peacefully to rest on the 23rd of February. He had lived a strenuous and useful life and had enjoyed the happiness of seeing a family of sons grow up and take their places beside him in the business he had established. He had had them trained in different branches of engineering and the firm of James Pollock, Sons & Co., Ltd., once purely marine engineers and naval architects, soon became nearly as well known as structural engineers and export merchants. Mr. Pollock served his apprenticeship with Messrs. J. & A. Blyth, of London, returning nearly twenty years later to take up the position of designer to them. During the years intervening he had seen service—often of an exciting character—in Eastern Siberia, on the river Duna in Portland, in Portugal, on the Atlantic Coast blockade-running during the American Civil War, etc. Before rejoining Messrs. Blyth he served for two years with Messrs. Lewis & Stockwell, of Blackwall. In 1875 he established himself in business in Great Tower Street as a consulting engineer, and has designed and superintended the construction of several hundred vessels, retaining to the last some of his first clients. Mr. Pollock was a member of the Institute of Mechanical Engineers, of Marine Engineers and of Naval Architects and was seventy-two years of age at his death. The late Mr. James Pollock was one of the cheeriest of men. He stood high in his profession and high in the estimation of all who knew him, and will long be remembered by all with whom he came in contact.

Thomas Napier Armit.—We regret to have to put on record the death of Mr. T. N. Armit, managing director of the East Coast Salvage Co., Leith, which occurred with painful suddenness as the result of a paralytic seizure within his residence at Trinity, Edinburgh, on March 4th. Deceased, who was in his 64th year, was an expert of renown in ship salvage work, and his name is associated with many notable feats in connection with such undertakings. He was a native of Montrose, and in his seventeenth year was apprenticed to Messrs. Alex. Stephen & Sons, shipbuilders, Dundee, in whose employ he remained for ten years. About 1871 he entered upon salvage work in Glasgow, and for a number of years served on the staff of the Glasgow Underwriters' Association. In 1878 he began business for himself at Dundee, and his success in raising sunken vessels and other salvage work was so marked that following upon the memorable disaster of the wrecked Tay Bridge in 1879, he was engaged to superintend the raising of the submerged material. In five months' time 7,000 tons of girders, etc., as well as the locomotive and train, had been raised from the bed of the Tay. His record, subsequently, was one of successive notable performances in salvage work connected with wrecked ships, many of them involving ingenious and novel methods. He was the pioneer of under-water building—that is, erecting water-tight structures on the top of submerged vessels—and in this manner succeeded in raising many wrecks. The first vessel ever raised by this method was the iron clipper ship *Colombo*, sunk at Panama in 1876, and later the same plan was advised by Mr. Armit in the case of the *Austral* in Sydney Harbour, and was successfully carried out by Mr. Eldridge. In 1883 the steamer *Daphne*, which capsized on the Clyde while being launched—124 workmen being drowned—was successfully raised from the river channel under Mr. Armit's management in a few days. A later and much more difficult undertaking was the floating of the Anchor Line *Utopia* (2800 tons) in the open Bay of Gibraltar, where through collision she lay in forty fathoms of water. Ascertaining by telegram the depth of water over the bow and stern, and furnished with the plans of the ship, he prepared in Glasgow the whole of the caisson required. This was attached to the submerged ship, picee-by-piece, eight divers accomplishing the work within two months. The hole in the side of the vessel was then closed, and the ship made fit to float to this country without being dry-docked. Another example of exceptional difficulty was that of the *Wick Bay* about seventeen years ago. This vessel (1,900 tons) stranded in the channel, near King's Lynn, broke in two, and remained obstructing the channel for four years before the East Coast Salvage Co. contracted with the Corporation of King's Lynn to raise the wreck, which had been subjected already to the unsuccessful attempts of four different salvage companies. Under the experienced and resolute charge of Mr. Armit and his staff the specially difficult task of raising the vessel and clearing the channel was successfully completed at a cost to the Corporation of King's Lynn of £18,000. Another and more recent notable success of Mr. Armit's was the salving of the large twin-screw cable-laying steamer *Anglia*, which went ashore on the rocks at the entrance to Strangford Lough, co. Down. In this case—the vessel being 450 ft. long, and about 5,000 tons weight—salving was accomplished less by tackling the vessel herself than by blasting away the rugged barrier of rocks over which she had been driven at high spring tide. After painstaking and skilful efforts the temporarily patched vessel was drawn into deep water over launching ways, and was towed to Glasgow, where in one of the Clyde Trust Graving Docks she had almost one-third of her bottom plating renewed. Mr. Armit naturally had many interesting reminiscences of ship salvage and its difficulties. Having also a literary bent, he was in request for lectures on the subject, and was to have delivered one on March 8th before the Royal Forth Yacht Club, Granton. Of a robust and genial personality he was respected and admired in shipbuilding and shipping circles generally. He is survived by a widow and family, one of his sons being Mr. Napier Armit, advocate, Edinburgh.

REVIEWS.

Les Flottes de Combat en 1910. By Commandant de Balincourt. Francs 5. Paris and Nancy: Berger Levrault et Cie.

The present edition of this excellent publication is for 1910, and has been brought up to date, containing a general view

of the various navies of the world. The book will prove of great interest to those who require to know the fighting strength of the navies of the world. Many old-fashioned battleships and cruisers are being dropped out, so that what remain are those which may be found in the line of battle. We are glad to see as regards our own ships that the *Bellerophon, Téméraire, Superb, Saint Vincent, Collingwood, Vanguard, Neptune* and the *Colossus Hercules* are now specified as having been built on the same lines as the *Dreadnought* with larger displacement and with four others to be now commenced. These various ships have a special drawing quite distinct from the *Dreadnought*, showing their arrangement with the ten 12-inch guns mounted in five fighting towers, so that the offensive power of these vessels can well be distinguished as being the present leaders of the fighting ironclads. A special note deals with the Navy of Germany, where it is stated that Germany, having their eyes fixed upon England, are pressing all their resources to build up *Nassau* types of vessels something like the *Dreadnought*, though the displacement is less than the new "Dreadnoughts" that we have built and are building. We see, however, that the calibres of the guns are less than those of the "Dreadnought" class, being about 11 in. as compared with our 12-in. guns, but in the German build they carry twelve of these guns in six fighting towers as compared with ten in the "Dreadnought" class.

Internal Lubrication of Steam Engines. By T. C. Thomsen, M. Soc. D.C.E. Price 2s. 6d. London: The Technical Publishing Co., Ltd.

IN the engineering world of to-day there is a much closer competition in the cost of power production. Beside the effective power consumed by the working machines, there is more or less loss through friction in the prime mover, and in the transmission gear. It is stated that in textile plants the power consumed by friction alone can be estimated at between 70 and 85 per cent. of the total power developed, and in engineering works at from 35 to 75 per cent., so that there is a large field open by studying lubricating oils to make a very considerable saving in this percentage of work wasted, and we are told that as much as 5 per cent. to 18 per cent. may be saved by those who use such oils. It has been somewhat generally held by some engineers that internal lubrication for some engines is not necessary, but it has been proved by practical tests that the absence of such internal lubrication has resulted in an increased expenditure of power, whilst steam will leak to waste past pistons and valves. The contents of this book are first upon the selection and distillation of crude oils, and then the characteristics of cylinder oils as regards their colour, flash point co-efficient of expansion and impurities are well set out. Details of the old method of lubrication, as compared with the indirect or modern method of lubrication, and various illustrations of the numerous cylinder lubricators are given, and afterwards details and illustrations as regards engines fitted with Corliss valves and winding engines for collieries. The question of a steam engine with superheated steam is dealt with, in which it is pointed out that the most serious part to lubricate is the high-pressure cylinder. The deposit in steam engines due to unsuitable lubricants or to boiler impurities is considered, also the dangers due to the oil in the feed water. The text book winds up with illustrations of exhaust steam oil separators and feed water purifiers.

The Newall Engineering Co., Blackhorse Lane, Walthamstow.—The considerable increase in the use of the metric system has induced this company to publish their standard tables of limits for diameters up to 150 m. m. in metric sizes, and we have received from them a card on which these tables are given. Copies of the card will be sent free to any applicant.

Verity's, Ltd.—We have received a booklet from Messrs. Verity's, Ltd., dealing with the Elephant range of tropical fans. On pages 8, 9 and 10 are shown fans suitable for ships' saloons and cabins. All the fans are tropically designed throughout, and insulated for use under the worst climatic conditions.

BOOKS RECEIVED.

Directory of Shipowners, Shipbuilders and Marine Engineers for 1910. Price 5s. London. The Directory Publishing Co., Ltd., 3, Ludgate Circus Buildings.

CORRESPONDENCE.

We do not hold ourselves responsible for the opinions expressed by our correspondents.

To the Editor of the MARINE ENGINEER AND NAVAL ARCHITECT.

Dear Sir,—We notice an article in your March issue headed "Propeller design versus manufacture."

The table referring to increased speeds of ships no doubt refers to our firm. We are quite of your opinion that $\frac{3}{8}$ to $\frac{1}{2}$ knot increase in speed is the maximum obtainable where propellers in cast iron are simply reproduced in bronze, having sections reduced to correspond with the greater strength of the bronze material. In fact, where a design is merely reproduced in such a mechanical and unintelligent way, we doubt whether even $\frac{3}{8}$ to $\frac{1}{2}$ knot increase is obtainable, except where greater care and greater accuracy are exercised in moulding the bronze propeller.

When, nevertheless, improvements in speed of more than $\frac{1}{2}$ knot are common where bronze is substituted for iron or steel, the result is due to other improvements in the design than the mere reduction of sections. With a little reflection it must be apparent that simple reproduction of the best cast iron or steel design in bronze, with thinner scantlings, is poor logic. In the case of the former materials the co-efficient of surface friction is very great and rapidly increases through corrosion and pitting. The bronze, on the other hand, has a low co-efficient of friction which, further, remains practically constant, throughout the life of the casting.

This consideration alone will show that the best propeller designs in cast iron and in bronze must always differ widely.

The second point of considerable importance is the lack of consideration hitherto often given to the proportions of propellers from the founders', as well as the engineers', point of view. Comparatively thin blades are frequently designed in connection with bosses or flanges heavy out of all proportion to the blades. Poor results must necessarily follow, both in respect of strength and accuracy of castings, in other words, in efficiency. At any rate, the speed results to which your leader refers afford some proof that the theories and ideas on the strength of which the disproportions above alluded to are supposed to be necessary, have a very doubtful scientific basis.—Yours truly,

FOR BULL'S METAL AND MELLOID CO., LTD.

JOHN C. BULL, Managing Director.

Yoker, near Glasgow, 10 March, 1910.

REPEAT ORDERS FOR MAIN PROPELLING MACHINERY. Our attention has been called to the large number of steamers which have been built during recent years of approximately the same tonnage, and from this it may be gathered that a vessel of 7,000 tons is considered a good type for ordinary cargo work, the machinery dimensions being designed to give the ultimate speed necessary, but to run economically at a lower average to meet contingencies. A list of steamers of this type, engined by Messrs. Richardsons, Westgarth and Co. Scotia Engine Works, Sunderland, shows that during the last twelve years thirty nine duplicate sets of engines and boilers (180 lbs. pressure) have been constructed for vessels of about 7,300 tons deadweight thirty six sets (160 lbs. press.) for vessels of about 6,300 tons seven sets (180 lbs. press.) and five sets (200 lbs. press.) for vessels of about 7,000 tons, and five sets for about 5,000 tons deadweight. Of these, twenty appear to have been built for Colonial or Foreign owners. The thirty nine duplicate sets in twelve years is a good record, and no doubt it has been an advantageous one in costs for both builder and owner and the firm is congratulated on this result.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Notable Launches.—Naval productions have again formed a feature in the launching activity of Clyde shipbuilding firms since last issue's notes were penned. These have included a second-class cruiser and two torpedo boat destroyers, all for the British Admiralty. The second-class cruiser, *Bristol*, launched by Messrs. John Brown & Co., Clydebank, on February 23rd, while similar in dimensions and armament to the *Glasgow* and the *Gloucester*, which were launched some months ago from Fairfield and Dalmuir respectively, differs from her sisters in the important essential of propulsive machinery. In the case of the two latter Parsons turbines are the agents, while in the *Bristol* propulsion will be through turbines of the Curtis type—an American invention for which the Clydebank firm hold the manufacturing rights in this country. Besides being the first vessel to be so fitted in this country the *Bristol* is the most powerful yet equipped with the Curtis machinery, and the results in her case are bound to be followed with the keenest interest. Other launches of some note because out of the common run of mercantile work were :—a twin-screw trailing suction hopper dredger for the Argentine Government having suction and self-discharging pumps capable of raising and discharging 6000 tons of material per hour—the largest and most powerful of her type yet constructed—by Messrs. Wm. Simons & Co., Renfrew ; and a twin-screw hopper steamer for conveying sludge from the sewage works of the Glasgow Corporation at Shieldhall. The latter was launched from the works of Messrs. William Beardmore & Co., Dalmuir, and is similar in design to, but of larger dimensions than, the sewage disposal steamer *Dalmuir*, built by the same firm some years ago for the Glasgow Sewage Works at Dalmuir.

New Contracts.—Although the record of notable launches of naval productions for the period under review is bright, it pales before the effulgency of the record of naval contracts secured during the same period. The Clyde shipbuilding, engineering and cognate industries, and all connected therewith have experienced the inspiriting influence of very substantial orders for high-class naval work, as well as for a fair average amount of mercantile tonnage. Brief particulars follow :—

The Fairfield Shipbuilding and Engineering Co., Govan, have received from the British Admiralty the contract to build and engine a cruiser-battleship of the *Indefatigable* type which is to be constructed under arrangement with the Government of New Zealand, just as in the case of a second and similar ship placed with Messrs. John Brown & Co., Clydebank, to be built under arrangement with the Government of Australia. The vessels will each cost about £1,800,000 and they are to form parts of the " fleet units " which are to be provided by the two Governments, but at the same time to be integral parts of the British Navy, and subject, under certain well-defined conditions, to the orders and regulations applying to the other ships of the fleet. The speed of the new cruisers, it is believed, will be 28 knots, and their length approximately 570 ft., the displacement being 18,000 tons. Besides the " Colonial Dreadnought " the Fairfield Co. have on hand the following naval contracts—the cruiser *Glasgow*, six destroyers for the Home Government (three of them launched), two for Australia (one launched and one to be sent out in sections).

Messrs. John Brown & Co., Clydebank, besides the order for the Australian cruiser above referred to have been commissioned to build and engine a steamer of 500 ft. in length for Messrs. Turnbull, Martin & Co., London to be engaged in the firm's carrying trade with New Zealand. Other naval work on hand at Clydebank yard consists of the cruiser *Bristol* (recently launched) and six destroyers (three launched).

Messrs. Mackie & Thomson, Govan, have recently booked an order for as many as ten steam herring drifters for a newly formed London company who, however, will operate the vessels from the northern port of Wick. The vessels, which are 80 ft. in length, will be engined by Mr. W. V. V. Lidgerwood, Coatbridge. Messrs. Mackie & Thomson have an old connection with Wick, having built for the port some years ago its first steam liners—the *Lapwing* and *Redwing*—a type of boat which was then just coming into favour in the North of Scotland.

Messrs. Barclay, Curle & Co., Whiteinch, it is reported, have been commissioned by Sir John Ellerman, Bart., to build and engine two large steamers, which are part of a batch of five similar steamers placed with builders elsewhere for service in the various " Ellerman " lines.

Messrs. Babcock & Wilcox, Renfrew, have received orders for the following naval boilers :—For the British battleships *Orion*, *Conqueror* and *Thunderer* each of 27,000 shaft horse-power ; for eight large torpedo destroyers for the Argentine Government—these boilers to be of the White-Forster type—and for two battleships of 35,000 h.p. each, for the Argentine Republic.

Messrs. Lobnitz & Co., Renfrew, for a gold dredger of their construction now at work on the Ankobra, South Africa, have recently shipped a complete patent propulsion screen to take the place of the existing revolving screen and elevator. This change makes a distinctly more efficient gold dredger and the present is the sixth gold dredger to be equipped with the improved device. Recently the rock cutter *Viking*, built by the firm, under the direction of Mr. R. Gordon Nicol, M.Inst.C.E., engineer to the Aberdeen Harbour Commissioners, has completed most successful trials, and is now in regular service removing granite rock in Aberdeen Harbour entrance. For Sir John Jackson, Ltd., the firm have recently been commissioned to build two hopper barges, duplicates of vessels built for the same owners last year for Singapore. The firm have also recently shipped an outfit of their patent rock-cutting plant to Canada to the order of the Canadian Government for the removal of rock in the St. Lawrence ship channel, capable of working to a depth of 45 ft. below water level.

Messrs. Russell & Co., Port Glasgow, early in March received an order from Messrs. Gow, Harrison & Co., Glasgow, for a steamer of 9000 tons carrying capacity, which will be a sister ship to the firm's *Valduia*. Engines will be supplied by Messrs. Rankin & Blackmore, Greenock. Messrs. Russell have at present on the stocks for the same owners a steamer of 7600 tons and two others of about the same tonnage for Messrs. Glen & Co., Glasgow.

Messrs. The Ailsa Shipbuilding Co., Troon and Ayr, who launched from their Troon yard on March 8th the steel twin-screw passenger steamer *Itauba* of 1850 tons, for Brazilian owners—through the agency of Messrs. John M. Campbell and Sons, Glasgow—have now started work on two other steamers, also for Brazilian owners, the orders for which were placed by Messrs. Campbell about the end of February. The Ailsa Co. have their steamer for the General Steam Navigation Co., London, well forward, and they are also making the engines for the steamer just launched, as well as the others now under construction at Troon and one at Ayr. They are also overhauling the steamers *Cordova* and *Charing Cross* and are altogether briskly employed.

Messrs. John Cran & Co., Leith, have recently put through speed and other trials the new Trinity House pilot auxiliary motor ketch *Solent*. This craft is noteworthy as being propelled by engines of the " Peck " type made by Messrs. W. Beardmore & Co., Dalmuir, and using paraffin as fuel. On a series of runs the little vessel averaged 7 knots, the engines running without a hitch throughout the trials, the results being considered most satisfactory.

Messrs. The Dundee Shipbuilding Co. have received an order through the Shipping Agency, Ltd., for a steamer for Canadian owners, to be employed in general cargo and passenger trade. She will be 145 ft. long, 24 ft. 6 in. beam and 10 ft. in depth.

Montrose Shipyard.—The shipbuilding yard lately occupied by the Montrose Shipbuilding Co., with heritable machinery and plant—feu £1 0s. 7d., ground annual 14s. 2d.—was sold by auction in Edinburgh on March 12th at the upset price of £4000.

New Sheer Legs for Aberdeen Harbour.—The Aberdeen Harbour Board has decided to erect without delay a new sheer-leg crane having a lifting capacity of 100 tons at Victoria Dock there, at an estimated cost of £6,500. The need for this has arisen through the fact that the existing sheer-legs, which were erected thirty-seven years ago, have been found of

insufficient capacity for putting the machinery on board a new steamer being built by Messrs. Hall, Russell & Co., Ltd., for Messrs. John T. Rennie & Son.

New Iron and Steel Works at Motherwell.—For the erection of new iron and steel works at Motherwell 10 acres of ground have been acquired in the district of Flemington by a company which will be known as the Glencairn Iron Steel Co., Ltd., and will engage in the rolling of all classes of structural material. It is expected that ground for the new works will be broken within the next week or two.

Glasgow Exhibition, 1911.—In connection with the Scottish Exhibition of National History, Arts and Industry, to be held in Glasgow next year, it has been deputed to the General Manager to take steps to arrange for a worthy exhibit of progressive ship construction from the earliest shipbuilding on the Clyde to the present day. This, it was suggested, might be done by means of large models floating on and housed beside the river Kelvin, which flows through the Exhibition grounds, and there would be great appropriateness in organizing this exhibit next year, as 1911 marks the centenary of the launching of the historic steamboat *Comet* for Henry Bell from the yard of John Wood, of Port Glasgow. A sub-committee has also been appointed to confer with the Scottish Aeronautical Society as to demonstrations of artificial flight. The new and the old in regard to navigation thus promise to be well thought out in the coming Exhibition, for which Mr. A. C. Freeman, C.E., Glasgow, has been appointed the engineer.

TYNESIDE AND WEARSIDE.

(*From our Own Correspondent.*)

Tyneside.

Sir Walter Runciman, at the annual meeting of the Moor Line, Ltd., during the past month has uttered a prediction that if commercial affairs are not disturbed by external pernicious influences, the shipbuilding industry is at the commencement of a revival of trade which would not partake of the character of a boom, but would be of a steadily increasing character. The pleasing effect of this prophecy is intensified by the fact that at the last annual meeting he was unable to support the more hopeful views that even then were beginning to be felt regarding a resumption of activity. That optimism is not absurd is also shown by the present state of affairs, as shown by the report of the directors of Messrs. Swan, Hunter & Wigham Richardson, Ltd., which mentions, among other items, two ships for the Grand Trunk Pacific Railway, a torpedo-destroyer, a floating "Dreadnought" dock and a graving dock caisson for the British Admiralty, a large steamer for the Australian trade, a passenger steamer for the Cunard Steamship Co., two other fast passenger steamers, a floating dock for the west coast of Africa, and a steamer for the hydrographic service of the Canadian Government, as being at present in hand. The chairman at the annual meeting said that there were decided indications that the shipbuilding business would be better during the present year than during the last two years, the difficulty, however, being that owing to the very keen competition for orders existing at present the price left very little margin.

Messrs. Palmers' Shipbuilding and Iron Co., Ltd., are making satisfactory progress with the battleship for the British Admiralty, the *Hercules*, which it is expected will be ready for launching in the early part of May. The guns and gun mountings for the boat are already well in hand, being supplied by Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., at Elswick.

Messrs Hawthorn, Leslie & Co., Ltd., of Hebburn, have obtained three out of four vessels, contracts for which were issued by the Booth Steamship Co., of Liverpool, for cargo and passenger service, each of about 6,500 tons gross, while an order has been received for a cargo boat from Messrs. Haldinstein & Co., of London, of about 7,000 deadweight capacity. The engines for all these vessels are to be constructed by the North-Eastern Marine Engineering Co., Ltd., of Wallsend, the boiler equipment also passing through this firm. Messrs. Hawthorn, Leslie & Co. have also passed the torpedo-boat destroyer *Zulu* through the speed trials with satisfaction, so that the boat is now ready for handing over to the Admiralty.

The Northumberland Shipbuilding Co., Ltd., of Howdon. It is reported that work is proceeding very briskly at this yard, all the berths being filled. Among other work which is expected in the yard before very long is a twin-deck steamer of 7,450 tons deadweight, a 7,200-ton boat for Messrs. Crossby, Magee & Co., of West Hartlepool, and a liner for Messrs. Wilson, Sons & Co., of Hull.

A very interesting scheme is stated by the local press to be in contemplation in order to replace the old ferry boat service which was abandoned last year. This is the establishment of a motor ferry service running from Newcastle to Hebburn Colliery, with nine stopping points. It is stated that a company is to be promoted to carry out the scheme and that four boats, each 50 ft. in length and 13½ ft. beam, to carry from ninety to 100 passengers, will be put into service. It is expected that the full journey will be made in from twenty to thirty minutes, and it will be interesting to see how petrol boats of this capacity will behave on continuous service.

A further indication of a revival of trade is reported in the Newcastle *Chronicle*, which states that with the removal of the steamer *Italiastan*, which was recently sold to Italian owners, there is now not a single idle vessel remaining at the Stanhope buoys, South Shields. It is stated that it is fully five years since the buoys have been completely cleared of laid-up vessels.

Mr. Jos. Ostens, who was until recently the general manager of the Shields Engineering and Dry Dock Co., Ltd., has recently left to take up the managership of the engine works department at Middlesbrough of Messrs. Smith's Dock Co., Ltd., and carries with him the friendship of his former colleagues as evidenced in the handsome set of presents from them.

Wearside.

There is a very much healthier tone prevailing among Wearside shipbuilding firms, and the prospect of a strong influx of work appears to be expected in more than one quarter. Local unemployment does not however, appear to be much on the decrease, as it will take some time, even in cases where drawings are actually passing through the offices, to get the yards into active operation again.

Messrs J. Laing & Sons, Ltd.—At this yard the initial difficulties concerning restarting with regard to the Corporation electricity supply have been satisfactorily overcome, and work has been started. A vessel is on order for Messrs. Bullard, King & Co., and immediately on the arrival of steel for the work a commencement will be made. The plant and machinery in the yard have in the interval been thoroughly overhauled.

Messrs. W. Doxford & Sons.—Work is reported to be well in hand at these yards, and it is probable that the works will be still more busy in the future. At the present time an order for a 7,500-ton single-deck steamer has been placed.

A very interesting addition to the fleet of the Tyne Tees Shipping Co. Ltd., is reported in the local press. This is a vessel now under construction at Messrs. Irvine's Shipbuilding and Dry Docks Co. Ltd., West Hartlepool, for passenger service between the Tyne and London, and which is to be completed in time for the summer season. The boat is to be over 300 ft. long and will have provision for 250 first class and 120 second class passengers. Its steaming capacity will be 15 knots. Considerable care is being spent on providing comfort and even luxury, the vessel being furnished in first class style and electric light being fitted throughout the vessel.

The death of a gentleman who was formerly most influential in local shipbuilding and engineering circles is that of Mr. J. H. Irwin, of Sunderland, who was formerly the managing director of the North Eastern Marine Engineering Co., Ltd. He was identified with the firm from the time of his apprenticeship, and rendered valuable service to the firm's prosperity. His age at death was sixty.

Following the construction of the *Monitoria* by Messrs. Osborne, Graham & Co., of Hylton, a paper was read by Mr. Haver on the "Corrugated Sides of the *Monitoria* and their Effect," at a meeting of the North East Coast Institution of

Engineers and Shipbuilders at Newcastle, and caused a very considerable amount of discussion. Great interest has been aroused in this novel form of cargo vessel construction.

THE TEES AND HARTLEPOOLS.

(*From our Own Correspondent.*)

Middlesbrough.

Messrs. **Sir Raylton Dixon & Co., Ltd.,** Cleveland Dockyard, have secured the contract to build two large self-trimming cargo boats about 400 ft. long for the American trade. They will be built under the superintendence of Messrs. W. Esplen & Sons, naval architects, Liverpool. The first boat is to be ready in July and the second boat in August. They are also very busy with other work on hand.

Messrs. **W. Harkess & Son** are fairly busy, but nothing fresh is reported during the month.

Messrs. **Smith's Dry Dock Co.** are very busy, and during the month have secured the contract to build a steel steam barge of about 800 tons for Russian owners, the price being said to be £11,000.

Messrs. **Richardsons, Westgarth & Co.** are reported to have secured the contract to supply the engine and boilers for a cargo steamer building locally; they are also fairly busy with both marine and land work.

Messrs. **Dorman, Long & Co.** have secured an order for 6,000 tons of steel work, comprising 400 bridge spans of from 7 to 105 ft., which are required in doubling the main line of the South Manchurian Railway from Dalney to Su-chia-tum. American bidding was very keen for this contract.

Stockton and Thornaby.

Messrs. **Blair & Co.** have secured the contract to supply the machinery for a 10-knot cargo boat to be built by Messrs. R. & W. Hawthorn, Leslie & Co., Hebburn. She will be about 400 ft. long and carry 7,300 tons deadweight on a moderate draught; she is to the order of Messrs. Haldinstein and Co., Ltd., London, and will be christened the *Framlington Court*. They are also busy with other orders on hand.

Messrs. **Robert Ropner & Sons** are busy with the work on hand.

Messrs. **Craig, Taylor & Co.** are now busy with the cargo steamer for the Allyn Line, Sunderland, the machinery for which has been placed with Messrs. Blair & Co.

Messrs. **Richardson, Duck & Co.**—Nothing new is reported. They are building a cargo steamer on the Isherwood principle, now in much demand, for Messrs. H. Fernie and Son. Prices remain very low and there is as yet not the revival in the cargo trade that was anticipated.

West Hartlepool.

Messrs. **W. Gray & Co.** are very busy. Among the new contracts are two cargo boats for Messrs. J. & T. Harrison, London, and four boats for Messrs. Stock, also of London. They have now more work than they have had for years, and are well booked up into next year both yards being well occupied.

The **Central Marine Engine Works** are very busy; besides engining all the boats for Messrs. W. Gray & Co., they are fitting a new boiler to the s.s. *Bothnia*, the steam yacht *Alacrity*, also new boilers for the s.s. *Flintshire* and several smaller boilers for Messrs. Crabtree & Co., Yarmouth.

Messrs. **Irvine's Shipbuilding and Dry Dock Co.,** Harboard Yard, are kept busy with co-partnery steamers, and are reported to have secured an order from Messrs. Furness, Withy & Co.; they have also been fairly busy during the month with repair work.

Hartlepool.

Messrs. **Richardsons, Westgarth & Co.** have secured the contract to supply the engines and boilers for the two steamers building by Messrs. Sir Raylton Dixon & Co. They will be of about 3,000 i.h.p. and fitted with the Howden forced draught system to drive the boats about 11 knots. Nearly all the work on hand is for early delivery, at least four of the contracts are passenger steamers, which entails extra work.

Messrs. **Irvine's Shipbuilding and Dry Dock Co.** report nothing new during the month, but are very busy with the work on hand, all the berths being occupied. They have also a large cargo boat to start with for Messrs. Furness, Withy & Co., and are negotiating for the building of a cargo steamer for local owners. A slight fire broke out in the hold of one of their newly launched vessels, but luckily was extinguished beofre any serious damage was done.

THE HUMBER AND DISTRICT.

(*From our Own Correspondent.*)

Hull Central Dry Docks and Engineering Co., Ltd.—This firm at all times seems to lead the way as regards docking and repairing steamers. Besides keeping their dry dock at full pitch, the Company has had to engage the Alexandra Dry Docks, Hull and Barnsley Railway Co., also the dry docks belonging to the North-Eastern Railway Co. The firm have dry docked fourteen steamers and have had several small jobs afloat.

Messrs. **Stewart & Craig,** engineers and boilermakers, have done fair business during the month, working on the following steamers and sailing ships:—s.s. *Ross*, engine-room and deck repairs, a new main funnel fitted; s.s. *Skaudia*, deck and engine repairs; sailer *Fortuna*, sundry deck repairs; sailer *Scottish Glen*, s.s. *N.G. Peterson*, sundry repairs on deck and engine-room; several local tug boats for engine and deck repairs.

North-East Coast Engineering Works.—This firm are going along steadily with repair work, and have had the s.s. *Braeside*, s.s. *Sawvi*, s.s. *Riversdale* for general deck and engine and boiler repairs; they have also dry docked the s.s. *Kentra*, of Liverpool, painted hull, etc., and done a fair amount of repairs to engines, boilers and fitted a new doubling plate on deck. They have had several enquiries for dry-docking steamers.

Messrs. **Earle's Shipbuilding and Engineering Co., Ltd.,** are keeping fairly busy, I understand. They have upwards of 3,000 hands at work in their yard. They have booked an order from the Admiralty for a small vessel, and are busy effecting repairs (overhauling) to the s.s. *Kirkham Abbey*, belonging to the Hull and Netherland Steamship Co. The s.s. *Bruno*, late Wilson Liner, sailed last month for America for her new owners, and will ply there.

Messrs. **Cochrane & Son, Shipbuilders, Selby,** have just launched two herring drifters, and have booked several orders.

Messrs. **Cook, Welton & Gemmell, Shipbuilders, Beverley,** have secured several orders for new trawlers for Hull and Grimsby.

Messrs. **Amos & Smith,** engineers and boilermakers, are lacking fresh orders for engines and boilers, but are otherwise fairly engaged with repairs for the Wilson Liners.

Messrs. **Cooper & Co., Ltd.,** engineers and boilermakers.—This old-established company keep in full swing as regards dry docking of steamers and general deck and engine repairs; their two dry docks have been fairly well employed. I understand they are very busy in their moulding shop at propeller work for foreign countries.

Messrs. **C. D. Holmes & Co., Ltd.,** engineers and boilermakers, have been spending a large amount of money improving their works in English Street. They are a firm of repute and their machinery and boilers can well stand the test of wear. Several old notable steamers are doing good work throughout the world. They have booked several orders for engines and boilers for trawlers, and the new branch repair shop situated at Alexandra Dock is in close touch with the dry docks and well able to compete for all classes of work.

Humber Iron Works have been very busy in slipping and dry-docking steamers, and generally busy in engine, smiths' and boiler shops. The ships are well booked forward. The s.s. *Haller* and s.s. *Cave* have had extensive repairs effected and several London barges have been in.

Wireless Telegraphy.—The Hull steam trawler owners are again advancing with the times. A few years ago they abolished the smacks, now they have trawlers fitted up to the highest of Lloyd's requirements and able to proceed to any part of the world. One trawler, the *Golden Cross*, steamed out to India from Hull, and is fishing in the Indian Ocean; others, I believe, were acquired by the Government of Australia, and steamed all the way from Grimsby. The Hull Steam Fishing and Ice Co., Ltd., who are the

owners of the Red Cross fleet, have fitted up the s.t. *Vincent*, which is the flag ship of the fleet, with wireless. She has been thoroughly overhauled, and a snug little receiving and transmitting room has been built just aft the bridge. Fitting wireless on a liner, where there is plenty of room to spare, is a very different undertaking from rigging up a suitable operating-room on a steam trawler, where every inch of available space is used for stowing away fishing tackle and coals. The *Vincent* is the first wireless-equipped British steam trawler, that has sailed from our shores. It is impossible to estimate the great value that may accrue from this development, but it is the intention of the owners to be in constant communication with the fleet, so as to regulate the fish supply in the Hull and London markets. At the present it takes a steam cutter three days to locate the fleet. It is anticipated that if the trials are successful, all the principal fleets will have wireless apparatus installed.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

Messrs. Day, Summers & Co., Ltd., Northam Iron Works.—The steam yacht *Honor*, owner Baron de Forest, completed her refit and left the yard last month, having been chartered to an American gentleman. The s.y. *Medusa* was lying at the buoys last month fitting out, also the s.y. *Sabrina* arrived at the yard to fit out for the coming season. The s.y.'s *Vanduara* and *Assagai* are also fitting out. The twin-screw tug *Neptune*, which the firm have just completed to the order of the Southampton, South of England and Isle of Wight Steam Packet Co., completed her trials last month. The *Neptune* is a sister vessel to the *Hector*, which Messrs. Day, Summers & Co. built for the same company a few years ago. The *Neptune* has a length of 130 ft. between perpendiculars, breadth 25 ft. and depth moulded 12 ft. 6 in., and is built to 100 A1 at Lloyd's. The machinery consists of two sets of compound surface-condensing engines, having cylinders 19 in. and 38 in. dia. with a stroke of 30 in. There are two single-ended marine boilers working at 120 lbs. pressure per sq. in. The engines are designed to develop about 1,500 i.h.p. The vessel is fitted with Napier's steam and hand-steering gear and Napier's steam and hand windlass and steam-warping capstan. From the above brief description it will be seen that the *Neptune* will be a powerful addition to the towing fleet at this port. The keel for a new passenger and cargo steamer has been laid and work is now proceeding on the framing, etc.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works.—H.M.S. *Savage*.—This vessel was successfully launched on the 10th of March, and at the time of launching had her masts, funnels, guns, boats, etc., all in position. The machinery was also in position, and nearly complete. The vessel will be ready for steaming trials early this month. H.M. ships *Larne*, *Lyra*, *Martin* and *Minstrel*. Work on these destroyers is steadily proceeding, and two of them are nearly plated. *Baron Horace Gunzburg* (shallow draught paddle tug for Russia).—This vessel has completed her official trials, when a speed of 14.4 miles per hour was maintained, the draught being under 16 in. fully loaded. This is a noteworthy performance for a side paddle boat of 140 ft. length. The vessel has been dismantled and shipped in sections ready for re-erection on the banks of the river Lena in Siberia. The vessel was completed well within the contract time. *Vulcano* (mine-laying and torpedo base vessel for Portugal). The official trials of this vessel were completed early last month, when she easily fulfilled all the requirements of the contract. It is anticipated that she will be handed over to the Portuguese authorities early this month, this delivery being about two months before the contract date. Repair Work.—Last month was an exceptionally busy one for the repairs department. The extensive alterations and repairs to R.F.A. *Mercedes* were completed, and the vessel was handed over to the officials at Portsmouth Dockyard on the 10th of last month after a satisfactory trial run. The following vessels were under repair or alteration at the latter end of March—H.M.S. *Research*, s.y. *Sapphire*, s.s. *San Antonio* and the s.s. *Claremont*. A rapid repair job was carried out early in March on the s.s. *Taormina*, which required a new tail shaft at very short notice. The shops have been well occupied during last month on the machinery for the vessels under construction and general engineering and repair work.

Messrs. J. Samuel White & Co., East Cowes, Isle of Wight, have received an order for three 50-ft. steam pinnaces from the Admiralty. H.M.S. *Harpy* came off the slip last month and it is expected that she will complete her official trials early this month.

THAMES.

(From our Own Correspondent.)

The New "Dreadnought."—The vessel being laid down by the Thames Ironworks at Blackwall is notified as to be named the *Thunderer*. Naturally comparisons are being made as to the differences that will be found in the latest of the name and her immediate predecessor, which was designed in 1869 and was one of the earliest armourclads. Whichever way the matter is looked at the difference is sufficiently striking. The earlier vessel had a displacement of 9,330 tons and a speed of only 13 knots, whereas the vessel now about to be built will displace about 26,000 tons and travel at over 21 knots. The guns in the one case, four of them, fired a projectile weighing 800 lbs. to penetrate 15 inches of wrought iron at 2000 yards, whereas the new *Thunderer* will possess ten 12-inch guns which will be able to fire 850 lb. shell through 20 inches of the hardest armour at a range of 3,000 yards. It is regrettable to note that the head of the firm, Mr. A. F. Hills, though directing the great concern building the vessel, is prevented by illness from active control.

The Docks.—It has been reported that the Port Authority propose to spend a sum of £52,000 on improvements at the London Docks by building new sheds and improving the docks generally. The Regent's Canal and Dock Co. declare a dividend of 2 per cent. for the half year ending Dec., 1909. The gross receipts for the same period amount to £44,000 and the expenses to £18,832. With what was brought in the balance pays the above dividend and carries forward £1,431.

Port of London Rates. This enquiry under Lord St. Aldwyn has been continued at Westminster there being 223 objections to the schedule proposed by the Port Authority. One decision was not to wholly exempt re-exported goods, but to leave it to the authority to deal with particular goods on their merits; another decision was that goods imported coastwise should be charged one-half any imported overseas. A point that came out in the course of the enquiry was that 1d. per ton is to be charged on coal imported coastwise and this will bring in £35,000 a year, and to favour the exports these will be charged only 50 per cent. of the import rates. The rates for fish imported are kept very low by the figures fixed for the benefit of a cheap food supply to the people.

Chamber of Shipping.—The annual meeting of this Chamber has been held in the City, and from the report it is satisfactory to note that no bills have been passed during the year detrimental to the shipping interests. The Marine Insurance (Gambling Policies) Bill is one of them, to prevent anyone not having an interest in a vessel from effecting an insurance. Complaint was also made of the Suez Canal rates being so high. The inefficiency of our coastguard service for protection of shipping was mentioned and complaint was made of railway companies running steamers at a loss as against general shipping interests.

The Council's Late Steamboats. A return has been issued showing the losses that have been incurred on the above unfortunate venture, with a proposal for repayment of the outstanding debt, whatever this may mean, within ten years from March, 1909. The boats less sales effected have cost £157,742. The pier transferred to the Port Authority account for £16,311, giving a total of £173,053. Pier and vessels remaining in the Council's possession stand at £61,710, with a grand total of £[illegible]. The rates will be charged £32,800 per year for ten years to pay the cost off. That is the substance of the proposal.

The Marine Society Anniversary. To celebrate its 154th anniversary the above society revived an ancient custom in the City, and twenty of the *Warspite* boys garbed in the picturesque dress of 1756 marched with [illegible] first to a short service at St. Lawrence Jewry and thence to Fishmongers' Hall, where a meeting was held with Lord Gro-

Hamilton in the chair. The first resolution was moved to the effect that the Society is doing a valuable national work in training British seamen. Between 1756 and 1909 it has fitted out and sent to sea 65,500 boys, of whom 28,500 have joined the Royal Navy.

MERSEY AND MANCHESTER SHIP CANAL

(From our Own Correspondent).

Messrs. Cammell, Laird & Co.—The annual meeting of this firm was held recently, when a gratifying report of the year's trade was presented. While the gross profits were higher than the previous year, close contract prices have made their effect felt. A large order book, together with a good outlook for the current year, will, it is hoped, make it one of the best for tonnage output. The various important contracts in hand are being pushed forward with despatch, the shops and yard being fully employed.

The "Highland Laddie."—The first of the four boats for the Nelson Line completed a successful trial on the 5th March. Mr. William Nelson expressed the opinion that it was the finest type of commercial vessel afloat. The refrigerating plant is of the latest type and has been installed under the direction of Mr. Samuel Woods, engineering chief of the Company. The two ferry steamers of a new type for the Wallasey Co. are being pushed forward for this season's service. The propelling machinery for H.M.S. unprotected cruiser *Blonde* is well forward, and will shortly be shipped to Pembroke. This consists of Parsons turbines and Yarrow boilers, to develop 18,000 i.h.p. The destroyers *Renard*, *Wolverine* and *Racoon* are nearing completion, and together with two similar craft of the river class will form a powerful addition to the Royal Navy. Work upon the hulls and machinery for the four Argentina destroyers is making rapid progress, a new draughting office to deal specially with this class of work having now become a necessity due to the acceleration of construction. A large amount of boiler work is in hand, both for steamers, local and foreign shipment. Work on the building dock for the construction of the floating dock, is making rapid progress. It is expected that the floating dock will be amongst the largest yet built, it being understood to be between 600 to 700 ft. long and 120 ft. wide. In the extensive dry and wet docks the excellent facilities for quick and efficient overhaul have been kept well employed. The palatial paddle steamer *La Marguerite* belonging to the Liverpool and North Wales Steamship Co., is now in dry dock having new boilers installed, besides a thorough overhaul to both ship and machinery. The pleasure steam yacht *Vagrant* is now completing her refit and repairing, including new boilers. The *Castlemore* and *Dalemore*, of Newcastle, have been in dry dock, the latter having been painted, had sundry repairs and tail shaft drawn in twenty-two working hours.

The Liverpool Engineering Society had a paper on "Recording Steam Meters," read by Mr. Holbrook Gaskell, B.A., A.M.I.M.E., on the 9th of March, useful results of the use of these both in engine and boiler rooms being given.

Liverpool University.—Prof. W. E. Abell, who was recently appointed to the Alexander Elder chair of Naval Architecture, gave his inaugural lecture on March 11th in the Engineering Theatre on "Naval Architecture, the art and its application," to an audience including many prominent shipowners.

Isle of Man Steam Packet Co.—The Board of Trade inquiry into the loss of the company's boat *Ellan Vannin*, was concluded, and judgment was given on March 12th, the finding being that the vessel left Ramsey in a seaworthy condition, but that in the absence of direct evidence it was impossible to express a decided opinion regarding the cause of the catastrophe. It was, however, considered most probable that the vessel broached to and being swept by heavy seas the after companion was washed away, causing the vessel to sink by the stern, the heavy seas thus breaking the bows, as found by the divers. There was no direct evidence of collision, neither was their evidence of any structural weakness. The same Company's steamer *Tinwald* is now being overhauled at Messrs. Cammell, Laird & Co.'s yard.

The Isherwood System of Ship Construction.—A lecture on this system of shipbuilding was given by the inventor, Mr. J. W. Isherwood, before the Liverpool Shipping Staff Association in Liverpool recently. Having had to exammine structural plans for Lloyd's registry for classification purposes, the chief points of weakness which often came to the knowledge of the speaker consisted of the deck being unable to resist buckling and fraction, thus proclaiming the need of some system of longitudinal stiffening. This was usually applied as a remedy. Mr. Isherwood, after much time and thought, brought out his system, which embodied this strengthening in the constructional design. Previously various forms of longitudinal framing had been devised, but with the exception of the *Great Eastern* very little was done until the introduction of his system in 1907. As is well known, this consists, generally speaking, of transverse frames or belts around the ship at intervals of about 12 ft., these being slotted around their outer edges to admit of continuous longitudinal stiffeners being fitted on deck sides, bottom and tank top, the chief advantages being greater structural strength, increased hold capacity for bulky goods, greater deadweight capacity, and for same weight carried an easier ship to drive. Various Liverpool owners were now building ships on this principle, and ships are now also building in other countries, including one vessel for service on the Great Lakes, 580 ft. by 58 ft. by 32 ft., for ore carrying. The system has now been adopted by twenty-eight shipowners and sixteen shipbuilders.

The Francis Fisher Sailing Ship Co., Ltd.—At a recent meeting of the members, it was decided to wind up the business, Mr. Wm. Wainwright being appointed liquidator.

Messrs. H. & C. Grayson.—This firm have decided to open South End Works to suit vessels which berth at the south end of the town. For this purpose an agreement has been come to with Messrs. W. H. Potter & Sons. In the various departments trade still remains very brisk.

At the Brocklebank Dock the extensive repairs to the *Ayrshire*, including new rudder, are now completing. Extensive alterations and repairs are in hand upon the *Count Muranzi* in the Canada graving dock. The *Stanton*, which was damaged by grounding off Hightown, is also in hand. The Belfast steamer *Magic*, amongst others, has been through her annual overhaul. At the Birkenhead yard the Great Western Railway Co.'s steamers *Pembroke* and *Ibex* are being overhauled. Repairs are also being done to the steamers *Lingyard*, *Antelope*, *Kestrell* and the Limerick steamer *Sinainn*.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

The Turkish Rumours.—A statement has appeared in the press to the effect that the Turkish Government had placed orders amounting to some £5,000,000, and that Messrs. Vickers, Armstrong and Browns were to share. Messrs. Vickers were to build a battleship, as also were Messrs. Armstrong. That report is rather premature, but for all that it may intelligently anticipate what will really happen soon. There is the usual talk of American and German competition for the work, and the statement has been made that the Americans considered they were certain to get the work. There is no doubt that we have struck up against American competition, but amongst the big builders in this part there is no great fear of the results of this competition, and at the same time there is no comparison in regard to the class of work. This country, and the north-west builders particularly, are vastly superior. It may be some time before things come to a head, but it will not be at all surprising to learn officially that Messrs. Armstrong and Messrs. Vickers are building a battleship each, and that the latter firm is supplying machinery for both.

Whilst on the subject of foreign orders it may be worth while to discuss the probable work that is likely to come from Russia some time. Russia is terribly slow over its great naval programme. It has mapped out a great scheme which is going to cost millions upon millions, and reports have it that orders are to be placed in this country. Sooner or later they probably will be. Russia badly requires a navy, for as a matter of fact it can only boast of a few capable vessels, none of which would stand an earthly chance

with a battleship of the "Dreadnought" type. But one of the difficulties in connection with the placing of such contracts will be the drawing up of the specifications. The Russians are such marvellous theorists that they ask for perfection and expect to get it. No British builder is going to turn out a vessel at a competitive price which has to come up to a standard far and away more exacting than the British standard of efficiency. They will be wary of Russia. Past experience has taught them so to be.

Mr. J. Dunn—Mr. James Dunn has retired from Messrs. Vickers' Board of Directors and is now the consulting naval adviser to the firm. The vacancy created by this retirement has been filled by Mr. James McKechnie, who resides in Barrow, and has control of the vast engineering department of Messrs. Vickers. The managerial staff of the works entertained Mr. Dunn to a complimentary dinner last month. Mr. McKechnie was in the chair, and there were some flattering speeches made. At this function there was a unanimous expression of admiration of Mr. Dunn's capabilities, his kindliness and his brilliancy. No gentleman has during his long career as naval architect made more friends. His career has been a brilliant one. Before joining Messrs. Vickers he was assistant director of naval construction to the Admiralty. He was the personification of courtesy, which endeared him to all who had any dealings with him. An American once described him as "one of England's courtliest gentlemen, a past master in the art of diplomacy and the cleverest man he had ever met in his 'trade.'" "Trade" is good. He took part as well as time would permit in Barrow's local affairs, and at many functions was accompanied by his charming wife.

Messrs. Vickers' Naval Works.—Things are gradually shaping in Messrs. Vickers' great yard. There never was such a range of work as at present. In one corner are strange-looking machines for testing the efficiency of flying machine propellers. In another part one sees the huge sides of the Brazilian floating dock rising. Further on preparations are being made for the keels of the huge 26,000 ton battleship-cruiser *Princess Royal* and the City cruiser *Dartmouth*. Over on the engineering side the boiler shops are full up with Admiralty work, where scores of boilers for the Babcock and Wilcox type have to be turned out in record time. The forging departments are busy. The casting shops are busy on the huge covers, etc., for the 70,000 horse-power sets and the fitting shops are eagerly waiting for the thousand and one parts from the forges or the casting beds to machine up and fit. In the gun shop there is plenty of work and much mystery over a strange gun of striking dimensions. At the fitting-out wharves are two submarines about complete, a Brazilian battleship and the City cruiser *Liverpool*. Messrs. Vickers are at full pressure and are likely to be with present orders, and of course they have not finished booking fresh work and will not for some time. There are several big things in prospect. There is no further talk of extension of works or of the dry dock, but it is only a question of time with both.

The Naval Airship.—Work is progressing quickly with the huge shed which is to accommodate the new naval airship, and the cradle on which the sections will be erected is in course of construction. Some idea can now be gained of the great size of the 600 ft. long shed. It stands a good height and is 100 ft. wide. Tests without end are being made in the several departments and the vessel, when it is completed, will contain many new ideas, both as regards the cooling and the machinery. In design also this airship will differ from the Zeppelin. I don't expect it will be ready before the end of July, or it may be August before it is ready. One thing is certain, Messrs. Vickers have struck another industry which will expand very considerably before many years have passed.

BELFAST.

(From our Own Correspondent.)

Messrs. Harland & Wolff.—Rapid progress is being made with the construction of the White Star liners *Olympic* and *Titanic*. The shell plating of the former has almost been completed, and the greater portion of the deck plating has been laid, while the framing of the latter vessel is well advanced. It is intended to launch the *Olympic* in October. All the building berths, at both ends of the yard, are occupied by vessels in various stages of construction, and at the fitting-out wharf, work on the Union Castle liner *Edinburgh Castle* is being pushed on to completion. The announcement of Lord Pirrie's having acquired the whole of the late Sir Alfred Jones' various shipping interests has been received in Belfast with considerable satisfaction, for the transaction is bound to result in further shipbuilding contracts for the Queen's Island.

Messrs. Workman, Clark & Co.—This firm have two Lloyd Brazileiro steamers at the fitting-out wharf, the *Minas Geraes* and the *Bahia*. The latter vessel will be ready for sea in the course of a few days from writing. They recently completed and handed over to her owner, Mr. W. A. Grainger, of Belfast, after satisfactory trial, the coasting steamer *Tenet*. The machinery for this vessel was supplied and fitted by Messrs. MacColl & Co. In the March issue of "The Marine Engineer" reference was made to the negotiations between Messrs. Workman, Clark & Co. and the Harbour Commissioners in connection with a ship-yard extension for the former. These negotiations have practically reached completion, and the Commissioners will lease to Messrs. Workman, Clark and Co. a plot of land of about 12 acres alongside their north yard. This firm have made rapid strides to the front in the shipbuilding world, and additional ground is required to enable them to increase their output of tonnage.

Harbour Notes.—The Harbour Commissioners have appointed Captain M'Dowell, who has for the past ten years been in the service of the Ulster Steamship Company, to be assistant harbour master. The Commissioners have under consideration the question of establishing a wireless telegraphy station in the port. The Midland Railway Company's Belfast-Heysham steamers are equipped with installations, and are thus able to communicate with each other, and also with Heysham, at which port there has been a station since the railway company first started the Belfast service. Should it be decided to put up a station at Belfast, other Cross-Channel steamers running to Belfast will probably adopt the system. Tenders have been invited for the purchase of the Commissioners' dredger No. 4, as she lies sunk in Belfast Lough. The dredger turned turtle and sank after being in collision with the Clyde Shipping Co.'s s.s. *Copeland*, and the disaster was accompanied by a regrettable loss of life, five of the crew being drowned.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Flying Kestrel.—On Feb. 24th, Messrs. J. T. Eltringham and Co. launched at South Shields a steam passenger tender, named *Flying Kestrel*, which has been built to the order of the Alexandra Towing Co., Ltd., Liverpool. She is principally intended to act as a tender to the Cunard Company, and other lines of steamships trading to the Mersey. She has a promenade bridge deck and a finely furnished saloon. The *Flying Kestrel*, which is 137 ft. long by 28 ft. 6 in., with a depth of 14 ft. 0 in. moulded, has been built to the highest class of Lloyd's and the Board of Trade for the passenger service. The engines have been constructed at North Shields, but the boilers have been supplied by Messrs. Eltringham & Co. from their own works. The boat has a certificate for six hundred passengers, exclusive of her crew, and is to steam 14 knots.

Hopper Barge. On Feb. 24th, the Blyth Shipbuilding and Dry Docks Co., Ltd., launched from their shipbuilding and graving docks works a 600 ton steel dumb hopper barge, built to the order of the North Eastern Railway Co., which has been specially constructed in connection with their various docks and harbours. Powerful machinery will be supplied by Messrs. Langyes, Ltd. of Birmingham and Messrs. Lobnitz and Co., Ltd., of Renfrew for raising and lowering hopper doors. This barge is the last of five which the Blyth Shipbuilding and Dry Docks Co., Ltd. are constructing at present for the Railway Co.

Lundy. On February 24th, Messrs. Richardson, Duck and Co. launched from their yard a steel screw steamer of the following dimensions: Length overall 31[illegible] ft. [illegible] in., breadth, 47 ft. [illegible] in., depth moulded 22 ft. [illegible] in., gross

tonnage, about 2,025 tons. Deadweight about 5,250 tons on a moderate draught. This vessel has been built to the order of the Largrove Steam Navigation Co., Ltd., of London (Messrs. Farrar, Groves & Co., managers), will class 100 A1 in Lloyd's register, and has been built under special survey. She is a single-deck steamer with cargo poop, long bridge from before foremast to abaft mainmast, and topgallant forecastle. The engines by Messrs. Blair & Co., Ltd., have cylinders 24 in., 40 in., 65 in. by 42 in. stroke, steam being supplied by two single-ended boilers having a working pressure of 160 lbs.

Bengrove.—On February 24th, Messrs. Craig, Taylor and Co., Ltd., launched from their Thornaby Shipbuilding Yard, Stockton-on-Tees, a finely modelled steel screw steamer to carry about 7,000 tons deadweight on a light draught of water. The owners, Messrs. Joseph Hoult & Co., Ltd., of Liverpool, were represented at the launch by Mr. B. Allen, of Liverpool, under whose superintendence the vessel has been built.

Cydonia.—On February 24th, Messrs. William Dobson and Co., launched from their shipbuilding yard at Walker a steel screw steamer which they have built to the order of the Stag Line, Ltd., (Messrs. Joseph Robinson & Sons, managers), North Shields. The vessel, which is built to the highest class of British Corporation Registry, is of the single-deck type, and of the following dimensions:—Length between perpendiculars, 331 ft.; breadth, 48 ft., depth moulded, 24 ft. 6 in. The owners' usual full and complete specification has been carried out in the construction. The machinery is being built by the North-Eastern Marine Engineering Co., Ltd., of Wallsend, and is of the triple-expansion type, having cylinders 22½ in., 36½ in., 62 in. by 42 in. stroke, with three boilers working at 180 lbs. pressure. Messrs. Wailes, Dove and Co.'s "Bitumastic" enamel was applied to the engine and boiler-room tanks.

Brantford.—On February 25th, the Northumberland Shipbuilding Co., Ltd., launched from their yard at Howdon-on-Tyne, a finely moulded steamer built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, to augment their fleet of fine steamers. The vessel is 365 ft. long by 51 ft. 4½ in. beam by 28 ft. 4½ in. deep, and has been built under special survey to the highest class at Lloyd's, with extra strengthening for special freeboard. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation which is very ample, being placed in steel houses on the bridge deck. This steamer has been specially designed with a view to rapid loading and discharging of homogeneous cargoes, the hatchways being very long and wide, and are arranged for grain carrying in bulk, a complete set of shifting boards being fitted throughout to latest Board of Trade requirements. Ample deck gear is provided, consisting of eight steam winches by Messrs. John Lynn & Co., Ltd., Sunderland, and a large number of cargo derricks to ensure the expeditious handling of cargoes. She is fitted with the usual water ballast arrangements for light passages. The machinery will be supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 40 in., 67 in. by 45 in. stroke, three large steel boilers with 180 lbs. pressure. This vessel will carry about 7,200 tons on a light draught and steam about 10 knots loaded at sea.

New Floating Dock.—Messrs. Swan, Hunter & Wigham Richardson (Limited) recently launched from their Wallsend shipyard a double-sided self-docking floating dock, with a lifting capacity of 8,500 tons, built to the order of Messrs. Elder, Dempster & Co. The dock is of the bolted sectional type, which combines the advantages of the great longitudinal strength of a box type of dock with facility for docking. The dock in question has been constructed in three sections, each of which represents a complete box dock, that is to say, with the side walls permanently joined to the bottom pontoon. When it is necessary to effect any repairs to the under water portion of the dock the three sections are detached one from another, and any two of them can lift the third section. The over-all dimensions of the dock are about 400 feet in length and 95 feet broad. The pumping plant is designed to lift the maximum capacity of the dock in about four hours. The boilers are placed in houses on the top deck of the walls. Specially large mooring bollards are provided on the pontoon. Each of the walls has two mechanical side shores to assist in centreing vessels to be docked. A pair of flying gangways or swinging bridges when closed give access from one wall of the dock to the other. Messrs. Cochran & Co., Annan, Ltd., have supplied three Cochran (Annan) donkey boilers, each fitted with patent seamless furnace.

LAUNCHES—Scotch.

La Resolue.—On February 24th, there was launched at Leith an auxiliary steel yacht, which has been built to the order of Mons. P. Lebaudy, of Paris. Of a yacht tonnage of about 820 tons, the principal dimensions are:—Length on water-line 168 ft. by 32 ft. breadth by 20 ft. 6 in. depth moulded. The propelling power is supplied by triple-expansion engines working at 160 lbs. pressure, having cylinders 13½ in., 22 in. and 36 in. in diameter by 24 in. stroke, with a two-bladed bronze propeller. She has three large Oregon pine masts, with hollow topmasts and other spars in proportion, on which she will spread a good show of canvas.

Suction Hopper Dredger.—On February 28th, Messrs. Wm. Simons & Co., Ltd., Renfrew, launched from their works a twin-screw trailing suction hopper dredger built to the order of the Argentine Government. This vessel, which is the largest and most powerful of her type yet constructed, is fitted with suction and self-discharging pumps capable of raising and discharging 6,000 tons of material per hour. Four sets of triple-expansion surface-condensing engines are fitted on board, so that all four sets are available for either propelling or pumping as may be required. Steam is supplied from four cylindrical multitubular boilers and one cylindrical multitubular donkey boiler constructed for a working pressure of 160 lbs. The auxiliaries in engine-room include independent main condenser, independent steam-driven air and circulating pumps, feed, bilge and service pumps, feed heater, filter and evaporator and auxiliary condenser, with independent air and circulating pumps. The main centrifugal pumps are connected to suction frame fitted in central well at stern. Water jets are arranged at the bottom of suction pipe. The hopper doors are controlled by very powerful hydraulic gear, the power being supplied from two duplex sets of steam pressure pumps. The hopper arrangements include "Simons" patent suction keelsons, which enable the load in the hopper to be discharged overboard for reclamation purposes. Steam hoist gear is provided for controlling the lower end of suction frame. Complete electric light installation is provided both above and below deck. Elaborate and spacious cabins are arranged for the accommodation of officers and crew.

Bristol.—The second-class cruiser *Bristol*, for the British Government, was recently launched from the yard of Messrs. John Brown & Co., Clydebank. The *Bristol* is a sister ship to the *Glasgow*, launched from Fairfield yard, and the *Gloucester*, launched from Dalmuir, some months ago. Like her sister ships, the *Bristol* is 453 ft. in length over all, and 47 ft. in breadth. Her displacement is 4,820 tons, and she will have a speed of 25 knots. In the other vessels the Parsons type of turbine has been used, but in the *Bristol* the Curtis turbines will be installed. The vital parts of the *Bristol* are protected by an arched steel protective deck, extending the full length of the ship, and the coal bunker has been so arranged as to give further protection to the machinery. There is a continuous inner bottom, sub-divided into a number of compartments, which will be utilized for the storage of oil fuel. The vessel's armament will consist of two 6-inch b.l. guns, ten 4-inch b.l. guns and two 18-inch broadside torpedo tubes.

Hubert.—Recently there was launched from the shipyard of Messrs. Barclay, Curle & Co., Whiteinch, the passenger and cargo steamer *Hubert* for the Booth Steamship Co., Liverpool. The vessel is a sister ship to the *Francis* launched in December last. She is of 3,700 gross tons, and her dimensions are:—Length between perpendiculars, 355 ft.; breadth, 49 ft.; moulded depth, 26 ft. 6 in. Messrs. Matthew Keenan and Co., Ltd., of London and Glasgow, have the contract to cover all the boilers and steam pipes on board. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the bunkers, and their "Bitumastic" covering to the tank top in boiler-room.

Koolga.—On March 10th, there was launched at Dundee the steamer *Koolga*, which has been built to the order of Mr. Thomas Cowan, Leith, for the Leith, Dundee and Southampton cargo service. The vessel is 240 ft. in length, and of 1,300 tons deadweight, and will have a speed of 12 knots.

Freight Steamer.—Recently there was launched from the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, a steel screw package freight steamer 248 ft. 6 in. by 43 ft. by 26 ft. 6 in., for service on the Great Lakes Canadian trade, to the order of Messrs. Steamers Agency, Ltd., of Montreal. Immediately after the launch, the vessel was placed in the Company's dock to receive her machinery, which has also been constructed by the builders.

Dunclutha.—On March 14th, Messrs. Russell & Co. launched from their yard at Port Glasgow a steel spar deck screw steamer of the following dimensions:—360 ft. × 40 ft. 3 in. × 28 ft. depth moulded, of a gross tonnage of about 3,050 tons, built to highest class at Lloyd's, and under Special Survey; fitted with triple-expansion machinery by Messrs. John G. Kincaid & Co., Ltd., Greenock, same having cylinders 25-41-68 × 48 in. stroke. The vessel is owned by Messrs. The Scottish Navigation Co., Ltd., Glasgow (Messrs. Glen and Co., Managers), and during construction was superintended by Mr. Evitt, the Superintendent of the Line. Messrs. Wailes, Dove & Co.'s "Bitumastic" Enamel was applied to the bunkers.

Shieldhall.—On March 12th, Messrs. William Beardmore and Co., Ltd., launched from their Naval Construction Works, Dalmuir, a twin-screw steamer of about 3,000 tons displacement, which they have built for the Glasgow Corporation, and which is intended for service in connection with the new sewage works at Shieldhall. The new steamer is similar to the t.s.s. *Dalmuir*, which Messrs. Beardmore built for the Corporation some years ago, but is considerably larger, her general dimensions being:—Length between perpendiculars, 260 ft.; breadth, 42 ft.; depth moulded, 16 ft.; built of steel, under Special Survey, to Class 2 B.S.* with the British Corporation Registry, and in accordance with the Board of Trade regulations. The vessel is constructed with seven water-tight bulk-heads from the keel to main deck, and a longitudinal central bulkhead, while the sludge tanks are built in four water-tight divisions which empty themselves through large valves in the bottom of the ship, and the most modern appliances have been supplied for the efficient working of the steamer, including a complete installation of electric lighting throughout the vessel. On the main deck abaft the bridge is a steel deck house, which contains the steam-steering gear, chart room, galley, and a comfortable saloon for the use of the Committee and Officials, painted white, with mahogany furniture, and heated by steam. The propelling machinery consists of two sets of independent triple-expansion engines, having cylinders 15 in., 24 in., and 41 in. diameter, with a stroke of 27 inches, and two multi-tubular boilers 13 ft. diameter by 11 ft. 6 inches long, for a working pressure of 180 lbs. per square inch, and supplied with the most recent improvements for efficiency and economy. Having been constructed with a forecastle and high bow, the new steamer will be able to do her work in all weathers, and is altogether a very complete vessel of her class. Messrs. Wailes, Dove and Co.'s "Bitumastic" Enamel was applied to the sludge tanks and bunkers, and the "Bitumastic" Cement to engine-room tank top, also decks in way of saloons and charthouse.

TRIAL TRIPS.

Hodder.—On February 24th, the new steel screw steamer *Hodder*, built by Messrs. William Dobson & Co., Walker, was taken to sea for her trial trip. In spite of the bad weather prevailing a speed of 14½ knots was obtained, which was exceedingly satisfactory. After the trial the vessel left for Goole to take up her station on the Hamburg route. (For particulars of Launch see February issue.)

Glencliffe.—On March 2nd, the s.s. *Glencliffe* proceeded on her official trial trip in Hartlepool Bay. The vessel has been built to the order of Messrs. Milburn, Lund & Co., Whitby and West Hartlepool, by Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool. A large party of shareholders from Whitby and district accompanied the vessel on the trial trip, during which a mean speed of 11¼ knots was obtained by the log, the weather being too hazy to take observations on the measured mile. (For particulars of Launch see March issue.)

Motor Launch Dart.—On March 3rd, this launch, which has been built to the order of the Crown Agents for the Colonies, by Messrs. Vosper & Co., Ltd., of Portsmouth, was taken for her speed trials in Portsmouth Harbour, when the contract speed of 11 to 12 miles per hour was obtained. The principal dimensions of the launch are:—Length, B. P., 35 ft.; beam, 7 ft.; and draught 15 inches. She is strongly built on the Carvel system, having two thicknesses of teak planking, one thickness being worked fore and aft and the other diagonally; the stem is straight and the stern rounded, having a tunnel arranged for the propeller to work in. Short decks are fitted at the forward and aft ends, the remainder of the launch being open. A comfortably arranged portable cabin is fitted at forward end of the motor, and a canvas awning is fitted all fore and aft, and canvas side screens are fitted on each side of the launch between the awning and gunwale. The propelling power consists of a powerful four-cylinder paraffin motor of the Gardner type, driving a single screw. The launch has been built for service in shallow waters in the East Africa Protectorate, under the design and superintendence of Messrs. Flannery, Bagallay & Johnson, of London, Liverpool and Rotterdam. The launch will be shipped to the Protectorate at an early date.

Mohacsfield.—On March 5th, the handsome steel screw steamer *Mohacsfield*, built by Messrs. Wm. Gray & Co. Ltd., for Messrs. The Doughty Shipping Co., West Hartlepool had her trial trip. The vessel and her machinery have been constructed under the superintendence of Mr. H. Brandon, and that gentleman represented the owners on the trial; Mr. James Innes represented Lloyd's Registry, Captain J. E. Murrell the shipbuilders, and Mr. Maurice S. Gibb the engine-builders. An average speed of 11½ knots was made, the performance of ship and machinery being entirely satisfactory. On the completion of the trial the vessel proceeded on her voyage to Barry to load. (For particulars of Launch see March issue.)

Trabboch.—The new steamer *Trabboch*, built by Messrs. Archd. McMillan & Son, Ltd., Dumbarton, and engined by Messrs. David Rowan & Co., Glasgow, for Liverpool owners, ran trials on the Firth of Clyde recently. The vessel, which is of the single-deck type, is of the following dimensions:—Length, 304 ft.; breadth, 50 ft.; depth moulded, 28 ft. 1½ inches, and is constructed on the Isherwood principle. The trial trip was in every way satisfactory, and immediately on completion of same the vessel left for Cardiff to load. (For particulars of Launch see March issue.)

Birchwood.—On March 11th, the handsome new steamer *Birchwood*, built by Messrs. Ropner & Sons, Ltd., of Stockton-on-Tees, made her official trial trip in the Tees Bay, after which she proceeded to Sunderland to load for Rio, under the command of Captain Wm. Mudd. She maintained an excellent speed of 10 knots against a strong head wind and tide, thereby showing an equivalent to about 11½ knots under favourable conditions. (For particulars of Launch see March issue.)

Tremont.—The large steel screw cargo steamer *Tremont*, built on the Tyne for Mr. Edward C. Hun, of Liverpool, was recently sent for her trials. Several runs were made on the measured mile off Whitley, when a speed of 11½ knots was attained, the machinery working to the entire satisfaction of the owners.

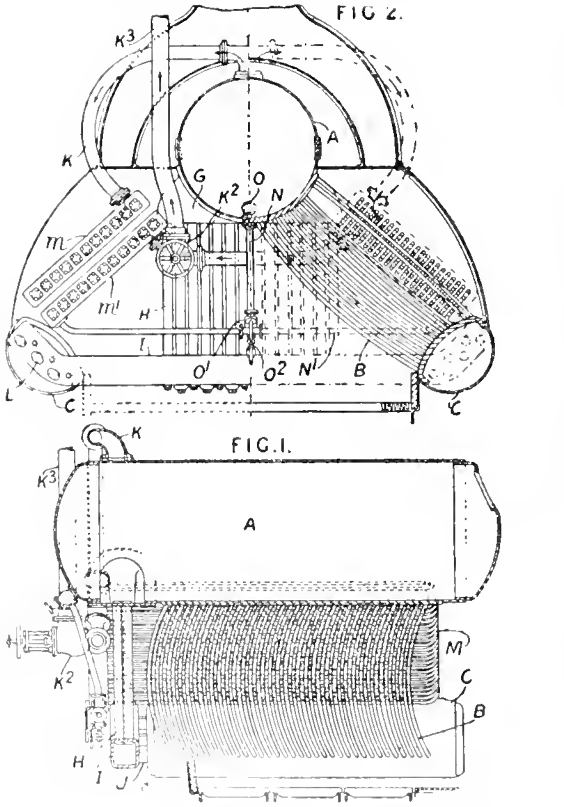
Treverbyn.—The new screw steamer *Treverbyn*, built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of Messrs. Edward Hain & Son, St. Ives, Cornwall, was taken to sea on her official trial trip. The trial was in every way satisfactory to all concerned, a mean speed of 12 knots being obtained. (For particulars of Launch see March issue.)

Kaduna.—On March 10th, the fine steel screw cargo and passenger steamer *Kaduna*, built by Sir Raylton Dixon and Co., Ltd., of Cleveland Dockyard, Middlesbrough, on the well known Patent Cantilever Framed Type, to the order of Messrs. Elder Dempster & Co., of Liverpool, proceeded to sea for her official trials. The trials passed off most successfully, and the vessel returned to the Tees to load. (For particulars of Launch see February issue.)

The Marine Engineer and Naval Architect Patent Record.

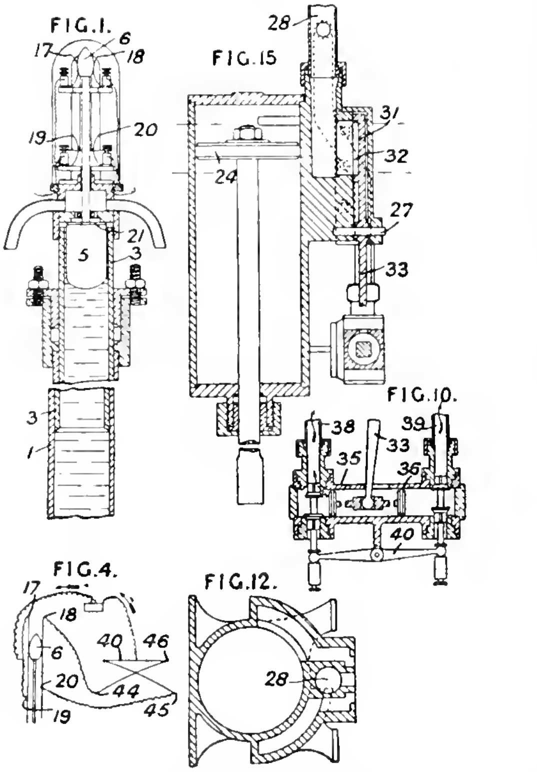
Compiled by Messrs. E. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

No. 22983. Steam Generators. Water-tube boilers, superheaters, steam.—A water-tube boiler of the White-Forster type described in specification No. 22222, A.D. 1897, is combined with external water-circulating and steam-superheating systems of the Babcock & Wilcox type. The water-circulating arrangement comprises a cross water-box G attached to the rear end of the steam drum A. Downcomer tubes H are expanded into the bottom of this box and the lower ends of these tubes are expanded into a long rectangular water box I, the ends of which are suitably bent to extend across the water drums C to which they are attached by nipples J. Suitable hand-holes L are provided in the box I opposite the downcomer tubes H and nipples J. A super-



heater M with a water flooding-arrangement is fitted above each bank of tubes B. Each superheater is composed of a series of U-tubes, the ends of which are expanded into boxes m, m1; the boxes m are connected to the steam inlet K and the boxes m1 to the outlet K3 through the valve box K2. The arrangement for flooding the superheaters is similar to that described in Specification No. 25402, A.D. 1896, and comprises a pipe N leading from the drum A to branches N1 in communication with the boxes m, m1, valves O, O1 being arranged to regulate the supply of water, while a valve O2 serves to drain the superheater. By preference the U tubes of the superheater are straddled over a number of the upper tubes of each bank B as shown in Fig. 2, a row af water-tubes being omitted to admit the legs of the U-tubes of the superheater.

No. 23879. Marine Governors. In a float governor for marine engines, with an electric transmitting-mechanism and a fluid relay, the float (5) is moved by a column of liquid, the maximum height of which is adjustable by altering the position of the tube (3) in the tube (1). The float carries an india-rubber valve (21) to prevent the flow of water from the top of the tube. A knob (6) is carried by the float and makes contact with the adjustable pieces (17, 18) at the top of its travel and with the adjustable pieces (19, 20) at the bottom, thus exciting one or other of two electro-magnets (not shown). Fig. 4 is a diagram of the electric circuits, the magnets being at the points (44, 45). The lever (40, Fig. 10), carries armatures at each end, which are attracted by one of the magnets. When the float is at the top, the magnet (44) is excited, the lever (40) is tilted, and the contact is broken at the point (46). Fig. 10 shows the lever in this



position, together with the relay cylinder for working the slide valve of the main relay cylinder. As the lever tilts, one end of the small cylinder is opened to the atmosphere and the other to the condenser vacuum through the pipe (38 or 39). The double piston (35, 36) is moved, and moves the lever (33). The lever (33) is pivoted at 27, Fig. 15, and at its upper end carries the slide valve (31). The valve seat has three ports, shown in Fig. 12, which converge towards the pivot (27), the central one being connected to the condenser vacuum through the pipe (28), and the other to the top and bottom of the relay cylinder respectively. The slide valve has a recess (32) which connects the central port to one or other of the outer ports, leaving the other open to the atmosphere. When the float makes contact with the pieces (19, 20) the position of the slide valve is altered, and the piston (24) is drawn down by the condenser vacuum acting below it and the pressure of the atmosphere above.

The following contracts have been placed with Messrs. Edward Hayes, of Stony Stratford:—Steel Steam Passenger Launch for Lisbon, 54 ft. long b.p.; 12 ft. 6 in. wide; fitted with "Hayes" Compound Surface Condensing engines, having cylinders 8 and 16 inches diameter by 10 inches stroke, and large marine return tube boiler built under Lloyd's Survey for 120 lbs. w.p. Two Steel Light Draught Twin-screw Tugs for Mesopotamia, each 60 ft. long by 11 ft. wide, 3 ft. draught; fitted with "Hayes" standard twin-screw set of machinery, each 6 and 12 × 8, and separate steam-driven condensing plant of new design. He is also building two single screw steel steam tugs about 50 ft. long, similar to those supplied to the Admiralty and various foreign governments.

The Marine Engineer

And Naval Architect.

LONDON, MAY, 1910.

CO-PARTNERY IN SHIPBUILDING.

THE experiment in co-partnery in shipbuilding, initiated by Sir Christopher Furness in the Irvine's shipyard at the Hartlepools about twelve months ago, does not seem from the workman's standpoint to be regarded as a success, judging by the decision of the majority who voted for the discontinuance of the scheme. In considering the matter from a broad standpoint, it must not be forgotten that a number of shareholders refrained from voting altogether. When the matter was in negotiation some eighteen months ago, we were surprised that the trade union organizations in the district allowed the scheme to take a tangible form, as there is not the slightest doubt that co-partnership between employers and employees is diametrically opposed to the principles of trade unionism, inasmuch as it sets up a vested interest in a particular works owned by a particular set of workmen, who are more likely to be influenced by their own personal interests than by the broad interest in any particular union of workers. Co-partnery tends to set up small industrial worlds of its own for the benefit of those in the partnership. This is very well exemplified by reference to the most successful co-partnery scheme in this country, *viz.*, that initiated by the late Sir George Livesey at the South Metropolitan Gas Company's Works, where the results have been most satisfactory, both to the shareholders in general and the workmen shareholders in particular, and no doubt the reason for this is that there is little or no fluctuation in the labour required, and the wages distributed are substantially even over a long period. The result naturally is that whatever view the union officials may have on any matter in dispute, the men themselves are bound by self-interest to do nothing to seriously interfere with the commercial prosperity of the concern in which they are shareholders, and from which they get regular employment, hence the authority of the union is weakened. As far as the Hartlepool experiment is concerned, the conditions are widely different from those recited above, as will be clear from the reasons given for the present opposition by the men. The three main reasons appear to be, firstly, that the scheme has not led to steadier employment than formerly; secondly, that the shareholder workmen have found it difficult to secure employment in other yards, and thirdly, that it is opposed to the interests of trade unionism. The first reason is a somewhat difficult one to understand as now put forward after the scheme has been in operation. Does the average workman think that the fact of his being a shareholder will tend of itself to increase the business of the concern, or will increase the laws, of supply and demand, which regulate the general trade conditions that obtain? The only point to be taken would be that under the better conditions obtaining between masters and men, the business can be carried on with less disturbance from labour troubles than have occurred in the past, and that a particular concern will get the character of delivering work to date, and at a price unhampered by unnecessary disputes. It is clear that such conditions could not be set up in twelve months, and on this ground the scheme has not had a fair trial. We suspect, however, the two last reasons combined formed the main objection, because, without suggesting any existence of obstructive organization, one knows perfectly well that moral suasion can be exerted to prevent men in the scheme getting jobs in other yards outside the scheme should they apply. We hope that something may be done to extend the scheme for a further period of trial.

STEAMSHIP REPAIRS BY ELECTRIC AND AUTOGENOUS WELDING.

OUR Continental neighbours have been far more enterprising than we in this country in the matter of steamship repairs by electric and autogenous welding. The subject, however, is again being brought prominently to the notice of those interested, as in February last an interesting paper on autogenous welding was read before the Institute of Marine Engineers by Mr. Leonard M. Fox, which paper was reprinted in our March issue. About the same time a paper on the same subject was read by Mr. A. Scott Younger, B.Sc., before the Institute of Engineers and Shipbuilders in Scotland. The point is emphasised in these papers that the reason that Great Britain as a maritime nation is not in the forefront in dealing with these new methods of repair is due to the innate conservatism of the British nature, which is consequently reluctant to depart from well-established practice that in the past has given satisfaction. The evidence that is to hand from our Continental neighbours as to the great advantages from a economical standpoint of adopting these particular processes for local repairs should tend to rouse the thoughts of shipowners and those responsible in these matters, owing to the fact that sufficient pioneer work has now already been done to enable the process to be looked at with greater favour than at present appears to be the case. There is no doubt that many thousands of pounds annually spent in ship repairs in this country could be saved if different methods were used than at present obtain. A useful illustration of this may be given when a flaw or defective weld is discovered in the heel of a sternpost. There is no doubt that in this country the post would in all probability be removed from the ship and partially renewed, whereas on the Continent the flaw would be welded up

at a mere fraction of the cost incurred here. Welding by the electric arc has, of course, been known for many years, and work carried out by these means was effected as early as 1881. Difficulties, however, arise owing to the hard character of the material at the weld, due to particles of carbon, when carbon electrodes are used, being absorbed by the molten iron, and this, in conjunction with other practical difficulties, has prevented arc welding from making general progress. A new electric welding process, designed to overcome such difficulties, has been invented by Mr. Kjellberg, of Gothenburg, according to which the work being carried out forms one pole, while the other pole is in the form of an insulated holder in which a steel rod is inserted, coated with a substance the composition of which is secret, but which appears to be in the nature of a flux. During the operation an electric arc is formed between the end of the rod and the work, by which the rod is raised to welding heat, and is pressed against the work, which is also raised to welding heat. Upon the molten drop being detached from the rod on to the work, the part is well-hammered and by repetition of the process the metal is gradually built up. Tests made on pieces of material jointed in this way show that the textile strength of the joined parts is nearly equal to the original plate, while by proper annealing of the parts dealt with, the elastic and yield point stresses are reduced in a marked manner, with a consequential increase in the elongation and contraction of area. Many interesting illustrations are given in the papers referred to, of instances of repairs carried out most successfully and even in difficult situations. Dealing more particularly with the autogenous welding which as is well-known is carried on by means of an oxy-acetylene blow-pipe, it may be pointed out that the great advantage appears to consist in the fact that when the combined gases issue from a properly designed blow-pipe the acetylene splits up into its component parts, hydrogen and carbon, at the base of the flame, carbon only taking part in the burning, due to the fact that hydrogen will not combine with oxygen at the temperature at which the carbon will, consequently the hydrogen remains free and forms a protecting zone at the blow-pipe tip, where the carbon is burning. The high flame temperature obtained, combined with the fact that there is a zone of free hydrogen, renders the flame very reducing and extremely suitable for many operations which would otherwise have to be carried out by a more costly, and probably less efficient, method, and in some cases would be altogether impracticable. The ordinary oxy-hydrogen flame is less than half the temperature of the oxy-acetylene, and has the further disadvantage of the difficulty of judging the exact mixture of the gases, the flame being either reducing or oxidizing according to the excess or shortage of oxygen. The oxy-acetylene flame has been used for cutting away the material, and where the integrity of the remaining structure is an important factor, great care must be exercised so as not to injure the surrounding structure. It will be remembered that last year the bow of the s.s. *Tenasserim*, which was badly damaged by collision, was cut away very successfully. Comparing the two methods referred to above it is stated that the test results in electric welding are more favourable, and it is suggested that it might be well to use the electric process where other processes would be inadmissible. Therefore in order to ensure good results in actual work it is desirable that the material used and the method of using it should be standardized. There is no doubt that the saving in time obtained by the named processes must be an enormous advantage to the shipowner who loses the use of his ship while under repair, and to those who have to pay the repair bills benefits of equal magnitude will accrue.

IRON AND STEEL INSTITUTE ANNUAL DINNER.—The annual dinner of the Institute will be held in the Grand Hall of the Hotel Cecil on Wednesday, May 4th, 1910, under the presidency of His Grace the Duke of Devonshire, supported by the vice-presidents and Council. Many noblemen and gentlemen have already promised to be present. The annual meeting will open on the 4th inst.

MESSRS. SWAN, HUNTER & WIGHAM RICHARDSON, WALLSEND AND WALKER-ON-TYNE.—This firm reached a pinnacle in the temple of fame when the *Mauretania* became an assured success on the Atlantic as a good and steady timekeeper for passengers. The pinnacle is not reached at one bound, but by close and persistent attention to the details which in the long run make or mar the whole work on which depends the running of an undertaking with profit to the seller and buyer alike. It pays both to have a good job well done. The *Mauretania* has previously been described in our pages, suffice it here to add that the anticipations formed of her have been realized, and she has been running now for three years as one of the favourite steamers on the Atlantic, and has carried the reputation of the builders with her. In the year 1906 the output of the firm reached a total of 126,921 tons, a record which has remained as a landmark. A *Mauretania* is not placed save in record-seeking days, but even in 1909 the output was 77,637 tons, while the average of the last six years was 83,839 tons; this amount, embracing the year 1906 is also a high record in the shipbuilding industry. The building of less pretentious vessels than an express liner occupies the yards and while there is capacity to undertake the latter, there are several other types which have been undertaken and sent forth on their different missions with credit to the designers and builders. Among these types are included, besides the ordinary traders of humble features, telegraph steamers with all their accessories for laying or picking up cables for repairs, train ferry steamers, floating docks for service at ports, where such are more convenient for local work than excavated and tidal docks. The well-known Bermuda floating dock was built and delivered by this firm after being towed out over 3800 miles: this is but one of many similar. The building of commercial vessels and appliances is not the boundary of the firm's operations; the more exacting work of building and outfitting of pleasure vessels and yachts is undertaken and carried out with the same care and attention that is bestowed upon other undertakings. The reference to pleasure steamers calls attention to the adoption of the gyroscope for counteracting the rolling movement in a swell or sea way, and the firm under notice has not only taken a deep interest in this apparatus, but has improved upon it, and supplies it to such vessels as are used for passenger traffic where required. The repairing departments are well equipped with appliances and tools to execute dry dock and repair work with expedition. There are two floating and one land dry dock, while the machine shops are adjacent and handy for carrying out any work or dealing with any details, from a propeller shaft to an eye bolt.

MARINE TURBINE PROPULSION.

THE problem of dealing with the high peripheral speed of the rotors in the steam turbine and the low surface speed of the propellers through the water in order to obtain the highest efficiency of the turbine as a motor on the one hand, and the propeller as a propelling agent on the other, has exercised the minds of marine engineers since the marine turbine came into the field as a practical and commercial motor. It will be remembered that some few months ago the results were published of some elaborate experiments made by Mr. George Westinghouse with a speed reducing gear designed by Rear Admiral Melville, of the U.S.A. Navy, retired, and Mr. J. A. Macalpine, to transmit 6,000 h.p., and having regard to the successful outcome of these experiments it was thought that a reasonable solution of a practical nature had been arrived at. We have lately been informed by Mr. George Westinghouse that the U.S. Navy Department has authorised the application of this class of gear with turbine machinery in the new Fleet Collier No. 8, now being built by the Maryland Steel Co., Sparrows Point.

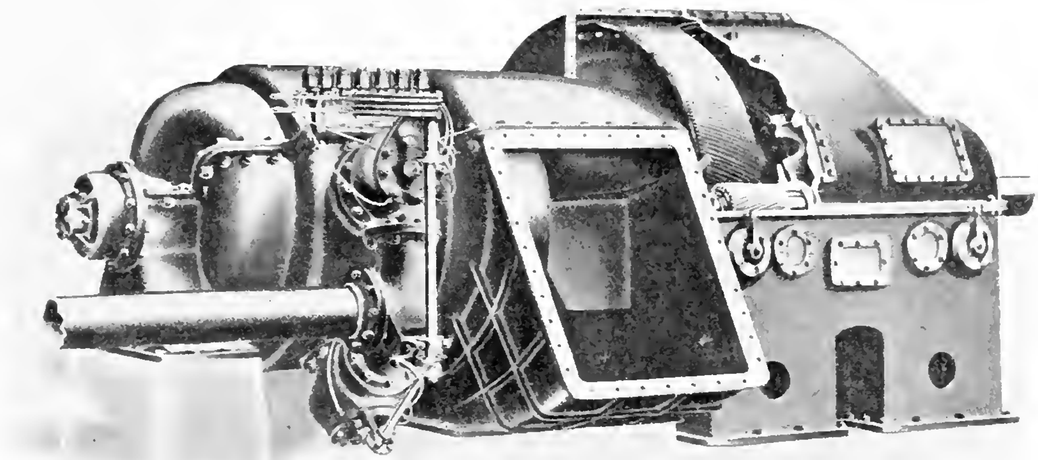


Fig 1

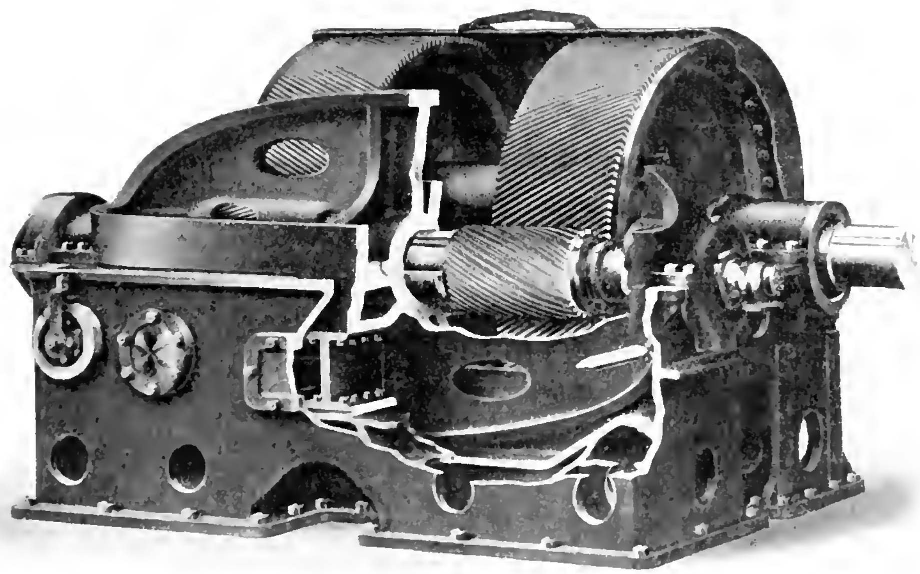


Fig 2

The turbines which are to be used are of special design to obtain the advantages of high rotative speed, great accessibility of parts and improved method of control.

We are informed that each turbine is to be a complete independent unit, with the high-pressure and low pressure ahead and astern turbines in one casing.

There is no complicated tangle of piping; a single pipe brings the high-pressure steam to the turbine, and a single direct exhaust connection to the condenser suffices for the astern as well as the ahead turbine, the exhaust from both sections communicating with each other through the hollow rotor.

The comparatively high rotative speed reduces the number of rows of blades necessary to efficiently utilize the energy in the steam, and the number is still further reduced by making the first and largest pressure drop through a single impulse wheel, instead of through a number of rows of blades of the reaction or "Parsons" type. When the steam has expanded to a considerable volume it is handled more efficiently by blading of the latter type, but in the earlier stages of the expansion, when the pressures are high and the volumes comparatively small, the energy is extracted with a properly designed impulse wheel just as efficiently as it could be with many rows of "Parsons" type blades. The greater compactness, due to the use of the impulse wheel, is a most valuable feature in a turbine for installation on board ship. With this construction the distance between the bearings becomes short, and the rotor is consequently very stiff, and has practically no tendency to set up vibrations which are not only annoying, but which necessitate wasteful clearances in order to avoid injury to the blading due to contact with the cylinder or the rotor.

Another advantage of using the impulse wheel for the earlier stages of the expansion is that the high-pressure steam at high temperature is confined to the nozzle chambers, so that the range of temperature and pressure to which the casing of the turbine is subjected is much reduced, and consequently there is less tendency for the casing to distort.

The ahead and astern turbines have impulse elements of the same size, but in the latter the complement of reaction blading is less. The power available for going astern is, however, unusually liberal, and the economy is sacrificed in a much smaller degree than is usual in marine turbine installations. Furthermore, all of the propellers are available for going astern, which is a decided advantage not commonly met with in existing turbine-propelled ships.

The impulse wheels have two sets of blade passages arranged concentrically, the outer annulus being considerably narrower than the inner one. When the turbine is working at low power one or two nozzles may be opened which discharge on the outer or smaller blade ring. For greater power one or two larger nozzles may be opened to discharge against the inner or larger blade ring. For maximum power all of the nozzles and both blade rings are brought into action. The nozzles are so proportioned, and can be operated in so many different combinations, that the entire range from minimum to maximum power may be covered in convenient steps without throttling the pressure in the nozzle chamber. In other words, the full expansive energy of the steam is available even when the vessel is running at the most moderate cruising speed.

In a marine turbine installation there is probably no single feature worthy of more serious consideration than that of accessibility. Space on shipboard is so valuable that the engine-room must be confined within the smallest possible limits, and it is consequently important that every precaution should be taken to design the machinery with especial reference to convenience in dismantling and opening for inspection and repair; it is therefore proposed that all pipe connections are made to the lower half of the casing, so that the cover can be lifted or swung back on hinges without breaking a single pipe joint.

In all other turbines of the Parsons type it is necessary to remove the rotor in order that access may be had to the blades of the lower half of the cylinder. The removal of the rotor of a large turbine is at best a laborious and tedious undertaking, and is attended with considerable risk of damage to the blading. On board ship, by reason of the congestion that exists even in the most liberally proportioned engine-rooms, the difficulties are multiplied. Furthermore, the time

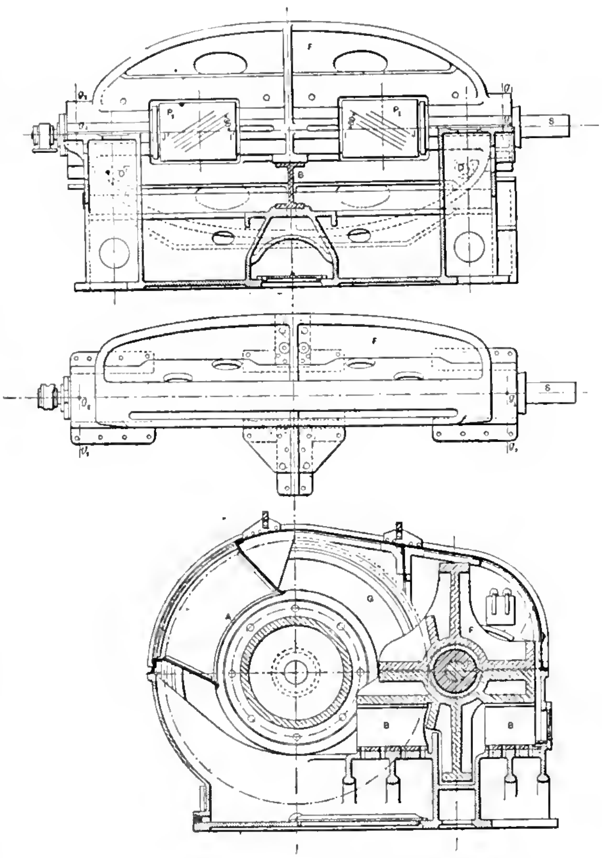


Fig. 3

required for making inspections and repairs is often a factor the importance of which it is difficult to overestimate.

A new design of cylinder blading in which the blades are mounted on flexible bronze strips, instead of being caulked into grooves in the cylinder, has been devised. The cylinder grooves are made much wider and deeper than usual, and are slightly undercut, leaving overhanging shoulders near the top. These blade strips may be slipped into the grooves where they cut through into the cylinder flanges, and light springs underneath hold them up against the overhanging shoulders. With this design the entire cylinder blading can easily be removed and replaced without

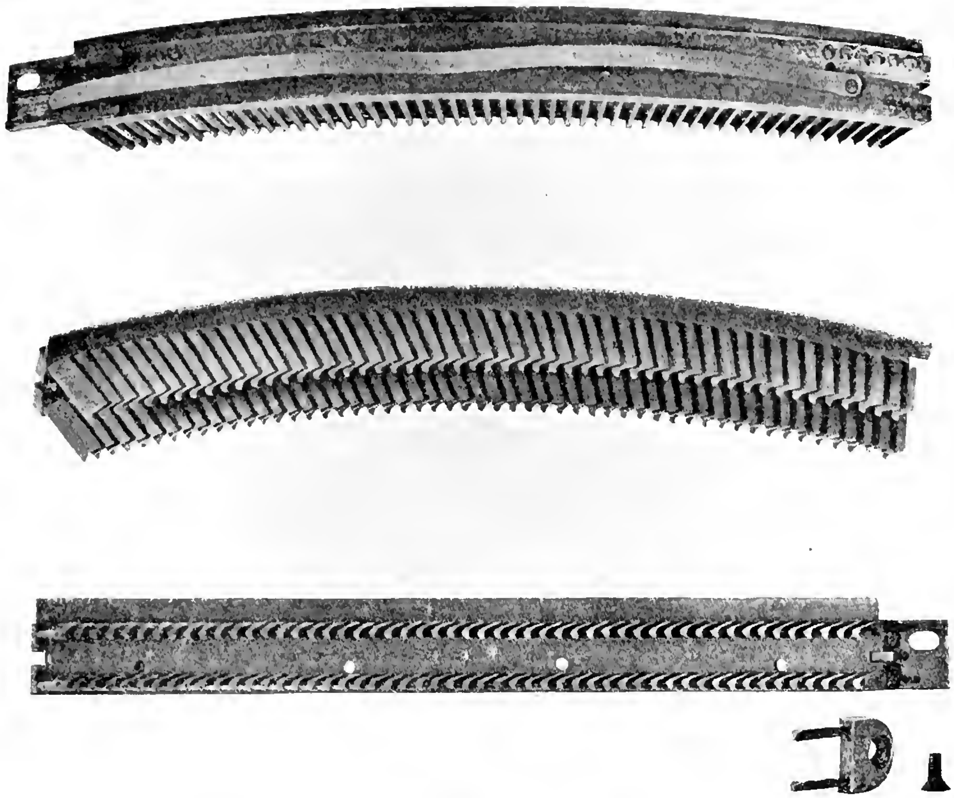


Fig. 4

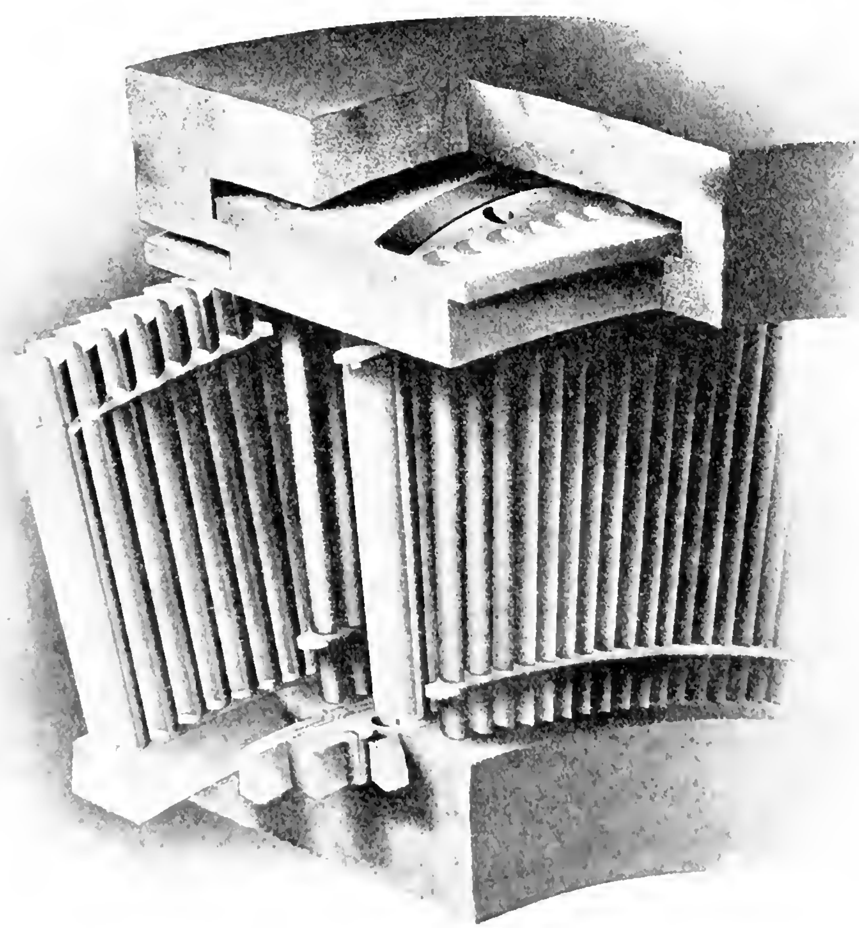


Fig. 5.

unseating the rotor. An entire spare set of blading can be stowed in a small space, and in case of necessity repairs could readily be made at sea by the engineering staff in an incredibly short period of time.

The bases of these blading strips are extended on one side so that they project over the tips of the corresponding rows of blades in the rotor, forming what is practically a removable bronze lining for the cast-iron cylinder. As the blade strips are backed up by flexible springs, the clearances between the tips of the blades and the cylinder or the rotor may be reduced to a minimum that would be impossible with rigidly inserted blading, as the yielding base strips prevent any rubbing contact that would be intense enough to bend or distort the blades. It has been found practicable to assemble the turbine with the blade tips in actual contact with the base strips and the rotor, and to allow the clearance to adjust itself by actual wear. This is, of course, an ideal method of getting the smallest possible clearance, and reducing the leakage past the blade tips to the lowest limit.

The practicability of this blading has been thoroughly demonstrated by actual trial in a turbine of over 20,000 h.p. capacity which has been in operation since April, 1908, and after the blading had been in service over seventeen months, it was inspected and found to be in perfect condition.

There are two independent throttle valves on each unit, one for the ahead turbine and one for the astern turbine. These valves are operated by simple levers, and are so designed that a continuous movement of either operating lever from the closed position, opens successively all the different combinations of nozzles, admitting the steam in constantly increasing quantities until the maximum power is attained.

While the turbine may be manually controlled by the engineer in accordance with instructions conveyed by the ordinary ship telegraph it is possible to control it directly from the bridge or from any one of several points on the vessel by means of an electro-pneumatic operating gear working on the throttle valve levers.

There are doubtless emergencies in which the small fraction of time saved by making the signal to the engineer on watch actually performing the desired operation in the engine room, would be well worth saving. Again, in case of the steering gear becoming disabled, steering with the screws would be particularly convenient and efficient, with the speed and direction of the engines under direct control from the bridge.

The bridge control is also of great advantage in fleet sailing or manœuvring. Whether it be desired to maintain alignment with the fleet sailing "line abreast," or to maintain distances with the fleet sailing "line ahead," it is not difficult to recognise the attractiveness of any proposition that contemplates immediate and accurate control of the speed of the ship, by the officer who is responsible for maintaining the proper alignment of distance.

This electro-pneumatic control is a thoroughly developed and standardized system, and has been used extensively for many years for operating railway signals and throwing switches at points far distant from the operator and for controlling the speed and direction of the motors on individual cars of long trains on electric railways. It must be noted that the instant the desired action has occurred in the engine-room, the fact that it has been accomplished is automatically signalled back to the operator so that there can never be any uncertainty as to whether or not the system is functioning properly. The failure of the electro-pneumatic control—the chances of which are very remote—does not interfere in the smallest degree with the ordinary system of signals and manual control, and therefore a duplicate system in fact exists.

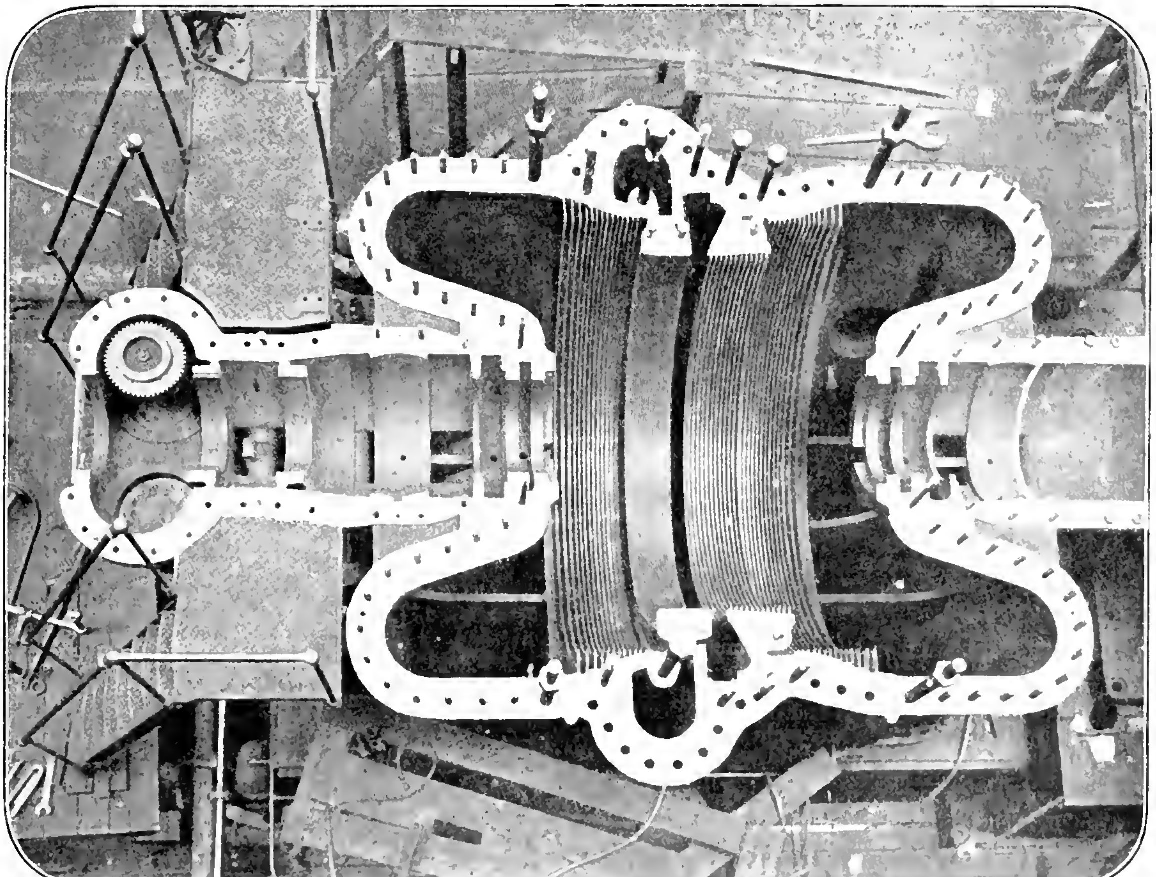
We have the opportunity of presenting to our readers some illustrations of the turbine and transmission gearing which will render it easy to understand the details of construction in each case.

Figure 1 shows a view of a turbine and gearing combined, a portion of the casing being removed from the device in order to show one set of the toothed wheels. Figure 2 is a perspective view of the gearing alone, parts of the casing being broken away, by which the two sets of gearing can be seen, together with the floating frame for carrying the pinions. Figure 3 shows in detail in three separate views the construction and mounting of the floating frame. Figure 4 shows three views of the removable sectional blading. Figure 5 shows the blading in place with the spring ring for maintaining a minimum of clearance between the stator and the rotor. Figure 6 is an illustration of the lower half of the casing of 20,000 h.p. double float steam turbine, bladed with the removable flexible self-adjusting blade as it appeared after working for seventeen months, and on dismantling was found to be in perfect condition.

Dealing more particularly with Fig. 3, it may be pointed out that the object of the floating frame is to ensure the continuous contact of the teeth along the whole of the length in order to avoid the transmission of the driving effort to parts of the teeth only. This feature is carried out by causing the alignment and position of the pinion shaft to be controlled only by the interaction of the teeth in contact, and not by the greater or lesser skill of the workmen in laying out and fitting the bearings, which, moreover, even if exactly right to start with, could not be depended on to maintain permanently their alignment. The frame F is a heavy steel casting flexibly mounted in the gear-box and supporting in rigid bearings the pinion shaft, but in such a way as to allow of this shaft having a slight longitudinal freedom, so that it can slide axially to and fro within the frame. Upon the bed-plate are mounted two flexible H-sectioned beams B, on the top flanges of which the frame F is supported. It will be noted that the wheels and pinions have helical teeth, each pair being at the opposite angle to the other pair, so as to eliminate end thrusts. It will be evident from the illustrations that the beams F act as a hinge, so that if the large gear G is not in place or the coupling connected, the axis of the floating frame and pinions could easily be deflected in a vertical plane through a small angle by a slight flexure of the webs. By reference to Figs. 4 and 5 illustrating the details of the turbine construction, it will be seen that the rows of blades are mounted in pairs on movable bronze strips which, could be bodily slid into or out of the grooves cut in the casing. These strips extend so as to meet each other on each side in such a way that the casing is practically completely lined with bronze, and are backed by relatively light springs. As before explained the yielding of the springs prevents any rubbing contact of sufficient intensity to bend or distort the blades, and the clearances gradually adjust themselves by

actual wear. These conditions were obtained in the turbine illustrated in Fig. 6, which, as we have already stated, was found in perfect condition after seventeen months' wear.

With regard to the weight of this kind of equipment compared with the power generated and transmitted, it is interesting to note that the manufacturers claim they can supply a rotor complete with blading for forward and backward motion which will weigh a little over $1\frac{1}{2}$ lbs. per horse power in sizes up to 15,000 s.h.p., while the number of blades in a turbine of from 7,500 to 10,000 s.h.p. will be about 15,000. The total weight of the turbine with rotor will not exceed 7 lbs. per h.p., while the weight of the gearing will be slightly less than 8 lbs. per h.p.



Marine Turbine Propulsion. Figure 6.

The advantages to be obtained by the great facility in the provision of an overload or emergency capacity, which would be of great value for naval purposes, should not be overlooked.

Institution of Engineers and Shipbuilders in Scotland.—The annual general meeting was held on the 20th April, Mr. C. P. Hogg in the chair. The following nominations for office-bearers were made: President, Mr. James Weir; vice-presidents, Mr. Thomas Arrol and Mr. E. Hall-Brown; ordinary members of Council, Mr. John Ferguson, Prof. A. L. Mellanby, D.Sc., Mr. R. T. Moore, D.Sc., Mr. Thomas Blackwood Murray, B.Sc., and Mr. J. R. Richmond; member of Council from Associate Class, Mr. W. S. Workman.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

Devonport Dockyard.

The battleship *Collingwood* was commissioned on April 19th for service in the First Division of the Home Fleet, in which there are now six vessels of the *Dreadnought* class. The *Collingwood* was laid down on February 3rd, 1908, and was, therefore, in hand ten weeks over two years. It was, however, known long ago that she would not be completed until the end of the financial year 1909-10. The cruiser *Lion*, it has now been officially stated, will be launched in August and the new ship will be laid down in January. For five months, therefore, the slip will be vacant, while not a single vessel will be laid down at Devonport during the year 1909-10. It certainly seems a pity that such a splendidly-equipped building slip should remain idle for such a long period. The progress made with the building of the *Lion* is being maintained, and she will be quite ready, unless anything unforeseen happens, by August, so that the launching date can be adhered to. The cruiser *Indefatigable*, too, is making good progress, the barbettes, boiler rooms, funnels, conning towers, and main deck fittings all being in an advanced state. There are three cruisers at present undergoing refits, the *Warrior*, *Talbot* and *Highflyer*. The refit of the *Warrior* is an important one and includes the installation of magazine-cooling appliances, the lengthening of the foremost funnel and refitting the net defence and fire control installation. The work on the *Highflyer* mainly consists of making good engine-room, boiler room and

magazine-cooling defects and her electrical and gunnery fittings are being brought up-to-date. It is anticipated that she will be commissioned for foreign service when completed. The *Pelorus* is practically completed and is ready to carry out her after-repair steam trial. She will probably be ready for the pennant early in May. The cruiser *Sutlej* has completed her annual overhaul and the flag of Rear-Admiral Galloway, commanding the local sub-division of the Home Fleet, has been transferred to her from the cruiser *Niobe*, which vessel is to be prepared for service as a training ship for the Canadian Government. The destroyers *Racehorse* and *Ostrich*, which were recently damaged in collision off Torbay, have been paid off for refit. The sloop *Espiègle*, upon the conversion of which from a hulk into an effective ship £15,000 has been expended, has been commissioned for temporary service in the Fourth Division of the Home Fleet at this port as tender to the *Europa*. It is understood that she will shortly be brought forward for service on the East Indies station. The *Espiègle* would be very useful in the Persian Gulf, where light-draught vessels are necessary for pursuing gun runners, who, when pressed, seek refuge in shallow waters. The cruiser *Æolus*, which has been refitted at Haulbowline at a cost of £20,000, has arrived at this port and joined the Fourth Division of the Home Fleet. The scout *Skirmisher*, which came in to have two defective propeller blades replaced, has had her defects made good and has left to rejoin the Second Destroyer Flotilla, to which she is attached.

Portsmouth Dockyard.

It appears as if the new financial year, which commenced on April 1st, will be a busy one for Portsmouth, as it is understood that the present number of workmen will be kept on. There are now nearly 10,000 here, besides those under the Director of Works. Our repair programme is certainly a small one, but it is bound to be more than actually appears in the Estimates. In addition to shipbuilding and repairs, £326,500 is to be spent on new works. The battleship *Orion* will, it is understood, be launched in August, but the building slip will remain vacant until January, as the new vessel is not to be laid down until the new year. Satisfactory progress is being made with the battleship *Neptune*, whose funnels are up and most of whose armour plates are in position. She will be rather different in appearance from her predecessors, as the two side turrets will be in echelon and the middle of the three barbettes on the centre-line will be on a higher level to that in the other "Dreadnoughts." Her steam trials, according to present arrangements, will take place in the late autumn. The commissioning of the battleship *St. Vincent* has been postponed in order that she might be placed in dry dock for alterations to be made to the inlets of her condensers to prevent the ashes from the ejectors finding their way in. The *St. Vincent* was laid down on December 30th, 1907, and has thus taken twenty-eight months to complete, but her construction was not at all hurried, and had it been necessary she could have been got ready in a much shorter time. The vessel is to be commissioned on May 3rd by Captain Nicholson to relieve the battleship *Irresistible* in the First Division of the Home Fleet, in which there will then be seven "Dreadnoughts." The battleship *Dreadnought* has completed her refit and has proceeded to Portland to resume her duties as flagship of the Home Fleet. The cruiser *Achilles*, of the Second Cruiser Squadron, arrived on April 1st from Vigo to be taken in hand for a refit. An important case was heard before the local magistrates early in the month, owing to the non-observance of the harbour regulations by the master of a merchant vessel, whereby Submarine *C* 18 was endangered. It appears that a collision was narrowly averted, the steamship actually grazing with her bow the starboard hydroplane of the submarine. The magistrates considered the case a very grave one and said that it was only skill on the part of Lieutenant-Commander Halahan, who was in command of the submarine, which prevented a disaster. They imposed the full penalty of £10. At the end of April Admiral Sir Arthur Fanshawe relinquished the command at Portsmouth, having been selected by the King for advancement to the rank of Admiral of the Fleet. His successor is Admiral the Hon. Sir Assheton Curzon-Howe, who has just vacated the command of the Mediterranean Fleet and returned home in his flagship the *Exmouth*. The cruiser *King Alfred*, the flagship of Vice-Admiral the Hon. Sir Hedworth Lambton, the late commander-in-chief on the China Station, has arrived here. On her voyage home the cruiser carried out a full power trial and reached 24 knots, which is a knot more than her contract speed. Not many vessels can do that after a commission in the Far East.

Chatham Dockyard.

Several large vessels have arrived to be taken in hand for refits during the month. One of them is the cruiser *Cressy*, which is to be paid off on May 9th preparatory to undergoing a large refit which will occupy seven or eight months. The battleship *Dominion* is to be overhauled prior to being recommissioned, and the cruiser *Antrim* has also come in to give leave and refit. At the end of April the battleship *Irresistible*, which is to be relieved by the *St. Vincent*, is to be detached from the Home Fleet and come here, when she will be paid off for an extensive refit. The *Triton* has again been placed in commission and has resumed her surveying duties around the coast, and the special service vessel *Hearty* has also been commissioned for surveying work. The battleship *Victorious*, the cruisers *Blenheim* and *Topaze*, and the mine-laying vessel *Andromache* have all left to resume their duties, and the refit of the battleship *Africa* has been completed. Among the vessels still in hand are the cruiser *Euryalus*, which is refitting, the cruisers *Naiad* and *Intrepid*, which are being converted into mine-layers, and the destroyer *Eden*. The new salvage and mooring lighter referred to last month has been designed by Sir Philip Watts, the Director of Naval Construction, and is to have a displacement of 790 tons. She will be able to lift submarines of the "*C*" class, and when completed will be stationed at Sheerness. The court-martial in connection with the stranding of the ocean-going destroyer *Saracen* was held on board the *Acheron*. That vessel, which for the last six years has been used as a training ship for stokers, has now been paid off, and when the necessary alterations have been carried out here she will be taken to Sheerness, where she will be employed as a coal hulk. Rear-Admiral Ommanney, the admiral-superintendent, who was appointed president of the Dockyard Engineering Association when he came to the yard, recently delivered a most interesting address to the members, in the course of which he warmly commended the objects of the Association. The Admiral said he thought his predecessor, Rear-Admiral Giffard, would be highly pleased at knowing that a cruiser was to be built at Chatham, because it was largely through the interest which he took in the matter that the vessel had been allocated to this yard. The vessel was not a large one, it was true, but they all hoped that it would lead to the yard again taking its place as a constructive establishment for large vessels. As to submarines, there was, in Admiral Ommanney's opinion, no yard that could hold a candle to Chatham in that direction. Mr. A. E. Horley, who had been here for some time past as assistant constructor, has been appointed to the permanent staff at the Admiralty.

Sheerness Dockyard.

Some extra work will come to the yard owing to the withdrawal of ten 27-knot destroyers from the Nore flotilla. They have previously been docked and refitted at Chatham, but as they now form part of the torpedo-boat flotilla attached to Sheerness their defects will be made good here. The vessels are now tenders to the torpedo school ship *Actæon*, and they will be berthed in Stangate Creek. The *Actæon* will in future provide such torpedo craft as may be required to be attached to the Gunnery School and the *Tenedos*, the training ship for boy artificers. The 27-knot destroyers are to be replaced later on in the Nore flotilla—which now consists entirely of 30-knot vessels—by boats of a more modern type from the First and Second Flotillas as they are relieved by new vessels. At the time of writing eight of the destroyers of the First Flotilla are refitting here, the *Amazon* and *Boyne* being the last to arrive from Harwich. The coast-guard cruiser *Squirrel* is in hand refitting, as are also three submarines of the "*C*" class. The torpedo-gunboat *Hazard*, which has had an extensive refit for service as a submarine depot ship, is now ready to commence her new duties, and has carried out a steam trial to test her new boilers. Lieutenant Newell, the fleet coaling officer at this port, has had his appointment extended for a year in recognition of the

fact that his labours in perfecting the coaling arrangements have been so successful. The old cruiser *Agincourt*, now *C* 109, will shortly be completed for service as a coal hulk. So far as the hold arrangements are concerned, she is complete and full of coal, but the equipment for loading and unloading, which is to be of the most up-to-date character, is not yet ready, and at present she is berthed in Kethole Reach until she can be finished off. The vessel will hold nearly 10,000 tons of coal, and when completed will be berthed above Port Victoria, with the *Jumna* and the other coal hulks. At the end of last month a leak was discovered in the hold of *C* 109, which had about 9,000 tons of coal on board. Tugs were sent from here and from Chatham, Captain Torlesse, the Captain-Superintendent, taking charge of the operations. An examination showed that the hulk was leaking on the port side aft, and it was necessary to shift coal from the after to the forward part so as to enable repairs to be effected. The leak, however, was not very serious. The *Acheron*, which was recently paid off from service as a depot ship for stokers, will have her engines and fittings removed at Chatham, after which she will be brought here to be fitted in a similar way to the *Agincourt* for service at this port. When the two vessels are available the coal storage accommodation available here will be increased by nearly 20,000 tons. The oil fuel accommodation has also recently been largely increased, provision having been made for storing 20,000 tons in the four steel tanks which have been built on the site of the shore end of the old Medway boom, opposite Burntwick Island.

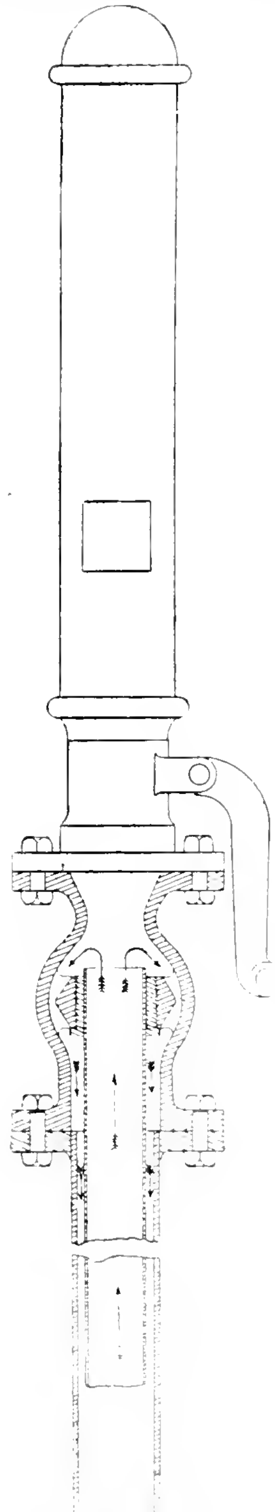
Pembroke Dockyard.

The delivery of the turbine-propelling machinery for the cruiser *Blanche* has been somewhat delayed, but it is expected daily. When the turbines are delivered, it will enable the contractors, who have the work of the boiler installation far advanced towards completion, to be ready for the steam trials in July, the date fixed when the contract was placed. The date for the completion of the *Blanche* is January next. The *Blonde* will probably be launched at the end of June, and June of next year is given as the date when she is to be completed. It was thought that our new ship would be put in hand immediately after the launch of the *Blonde*, but it does not appear likely as if that will be the case. No orders for material appear to have been placed, so it seems as if there is to be a departure in the design of the new vessels, they being now referred to as "improved *Blondes*." Both in the *Boadicea* and the *Bellona* exception was taken officially to the fact that when loaded as originally proposed they drew more water than the designer anticipated. As far as is known the reason was never satisfactorily ascertained. The constructive staff at the Admiralty are, it is understood, now endeavouring to deal with these difficulties. They desire to keep the new vessels as nearly as possible in their principal dimensions to the size of the *Blanche* and *Blonde*, but find it almost imperative either to increase the beam and depth, and also the displacement, or to increase the length. It is because a completely new design will be necessary in either case that delay has occurred. Owing to delay in completion, the orders for the torpedo-gunboat *Antelope* to be commissioned on April 16th as tender to the *Mercury* for service with submarines at Portsmouth were cancelled. The delay was sanctioned by the Admiralty, in view of a decision to build a wireless telegraphy cabin and to carry out other improvements. The result has been that the vessel will, when completed, be equipped with an up-to-date wireless installation. It is now understood that she is intended for service on fishery protection. Orders have been received for two fleet battle practice targets, and they will be put in hand shortly, as they are to be delivered ready for use by August. It seems a small job, but at any rate each of them will entail an expenditure of about £2,300.

THE report of Messrs. John I. Thornycroft & Co., Ltd., for 1909 states that the balance brought forward from 1908 was £1682, while the trading profit for the year 1909 totalled £40,672, together £42,355. Depreciation has absorbed £14,215. The directors recommend a dividend of 6 per cent. on the preference shares, leaving a balance to be carried forward of £1060.

PATENT CIRCULATOR FOR STEAM WHISTLES.

WE think it will be conceded that all seamen must appreciate the value of a clear blast of the correct duration for signalling in foggy



weather or close waters, where under the usual conditions which generally obtain the second and third

short blasts are in many cases completely stopped by a rush of water owing to condensation in the supply pipe, even if the first blast gets through without trouble, or similarly a long blast is choked immediately the sound issues, thus turning it into a short blast. Of course it will be seen that in such cases the signal reads the exact reverse of what is intended. Any device which at a reasonable cost will ensure a clear dry blast at any moment in the coldest weather, no matter how long the valve has been closed, will be very welcome among the shipping community, particularly if such a device at the same time ensures perfect immunity from leaky joints and frozen pipes.

With the above objects in view a circulating device for steam whistles has been put on the market by Messrs. Lester & Perkins, Royal Albert Dry Docks, London, E., which we illustrate in the accompanying diagram.

The device substantially consists in a distance piece inserted between the whistle and supply pipe, having an enlarged body and an internal socket or collar supported by a skeleton frame within the body, and in this socket is mounted a pipe which is led down into the ordinary whistle pipe in such a way as to leave an annular space between the internal pipe and the whistle pipe.

The action of the device is as follows :—The water which is continually formed owing to condensation of steam on the inside of the steam supply pipe is replaced by a constant supply of dry steam led up through the internal pipe, and takes a path indicated by the arrows. This action enables the water so formed to drop back into the boiler through the steam supply pipe, and in this way keeps the whistle and supply pipe always at a high temperature, with the result that any number of sudden or prolonged and successive blasts can be obtained without any difficulty whatever. The steam is taken direct from the boilers, and no non-return valves whatever are used in connection with its supply. In order to avoid the trapping of water which might interfere with the proper working of the circulator it is desirable that the whole of the supply pipe between the whistle and the boiler should have a gradual fall towards the boiler. Further, it may be pointed out that in the event of steam being taken from several boilers it is advantageous to the working of the circulator that all valves connecting the whistle with the boilers under steam should be left open.

Messrs. Leonard Chapman & Co., Importers and Manufacturers, Munton Road, London, S.E., report :
Graphite, as imported, according to quality.

	£	s.	d.		£	s.	d.	
Ceylon L.L. c.i.f. London ..	17	10	0	to	39	10	0	per ton
,, O.L. ,, ..	12	10	0	to	[illegible]	10	0	,,
,, chips ,, ..	10	10	0	to	29	0	0	,,
,, dust ,, ..	8	10	0	to	24	0	0	,,
Purified, milled and ground.								
Ceylon, 97% to 99%, f.o.b.								
London	59	0	0	to	63	0	0	per ton
,, 90% to 91%. ..	40	0	0	to	42	0	0	,,
,, 80% to 81%. ..	30	0	0	to	32	0	0	,,
,, 70% to 71%. ..	27	0	0	to	29	0	0	,,
American large flake, f.o.b.								
London	47	0	0	to	50	0	0	,,
,, small ,, ,,	38	0	0	to	47	0	0	,,
,, powdered ,, ,,	28	0	0	to	36	0	0	,,

Wholesale lists of tinned goods on application.

THE SCHMIDT SYSTEM OF SUPERHEATING.

IN our issue of May, 1909, we gave a full description of this system, and we now give illustrations and a further description of an installation which has been fitted to the Argo Company's s.s. *Schwan*, a vessel of 1,212 tons registered, 240 ft. long, 33 ft. 8 in. beam and 11 ft. 7 in. depth. This vessel is running weekly between London and the Continent, and is one of ten steamers owned by this Company in which the Schmidt Superheaters have been installed, giving on the average an economy in coal consumption of 15 per cent. The engines in this vessel are triple-expansion 19″, 32″ and 52″ diameter × 35″ stroke, working with a steam pressure at the boilers of 210 lbs. per square inch. There are two single-ended boilers, each of two furnaces, having a total heating surface of 3,000 sq. ft. and 68 sq. ft. of grate.

Fig. 1 shows diagrammatically the arrangement of superheater elements as fitted in the tubes of an ordinary Scotch boiler which will enable Fig. 2 to be more readily understood, as this is a photograph showing the superheater elements as disposed in one of the

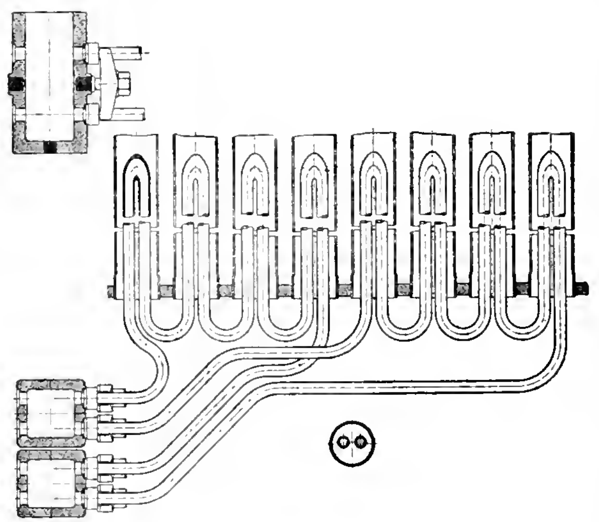


Fig. 1.

smoke-boxes. Fig. 3 is a view of the upper part of the engine-room, showing the control valves, so that the proportion of superheated steam to saturated steam can be regulated, if desired, for winch service.

For the main engines the steam is taken direct from the boiler to the superheater and from the superheater to the stop valve of the main engines. The boilers are worked under Howden's system of forced draught, the air heaters being shown in the upper part of Fig. 2. The main boiler tubes are $2\frac{3}{4}''$ external diameter, and the superheater tubes $\frac{3}{4}''$ external diameter.

The machinery of this vessel was not originally designed for superheated steam, and the superheaters were installed about one year after the vessel was first put into commission. Before the superheaters were fitted English coal was used, but since then German coal has been used. The steam temperature in the H.P. valve chest is about 620° F., and the auxiliary and deck engines are also worked with superheated steam.

As this vessel was an extremely economical ship before superheaters were installed the reduction in coal consumption is less than in other cases, and amounts to 13 per cent. On the basis of 150 steaming days per year this represents a coal saving of about £300 per annum. Before fitting the superheaters the boilers were rather hard to steam, and in order to obtain the required power about 2″ air pressure at the ash pits was required. Since using superheated steam the easier conditions of steaming are very agreeably felt, and only 1″ air pressure is now necessary in order to obtain full power at the engines. Under the original conditions the pressure dropped to 150lbs. per square inch when cleaning the fires, and it was necessary to partly close the throttle valve, thus reducing the speed of the ship until the full pressure was again obtained. This slowing up occupied from one to one and a half hours. Since the superheaters have been installed this condition of things no longer exists, and after cleaning the fires the full pressure is again reached in about ten minutes.

We have had the opportunity of inspecting the boilers of this vessel when loading in St. Katherine's Dock, and from what we saw of the installation it appeared to work very satisfactorily and no trouble whatever has been experienced in the main engines or auxiliaries owing to the use of superheated steam, and the Chief Engineer informs us that no burning or sooting-up of the tubes has been experienced.

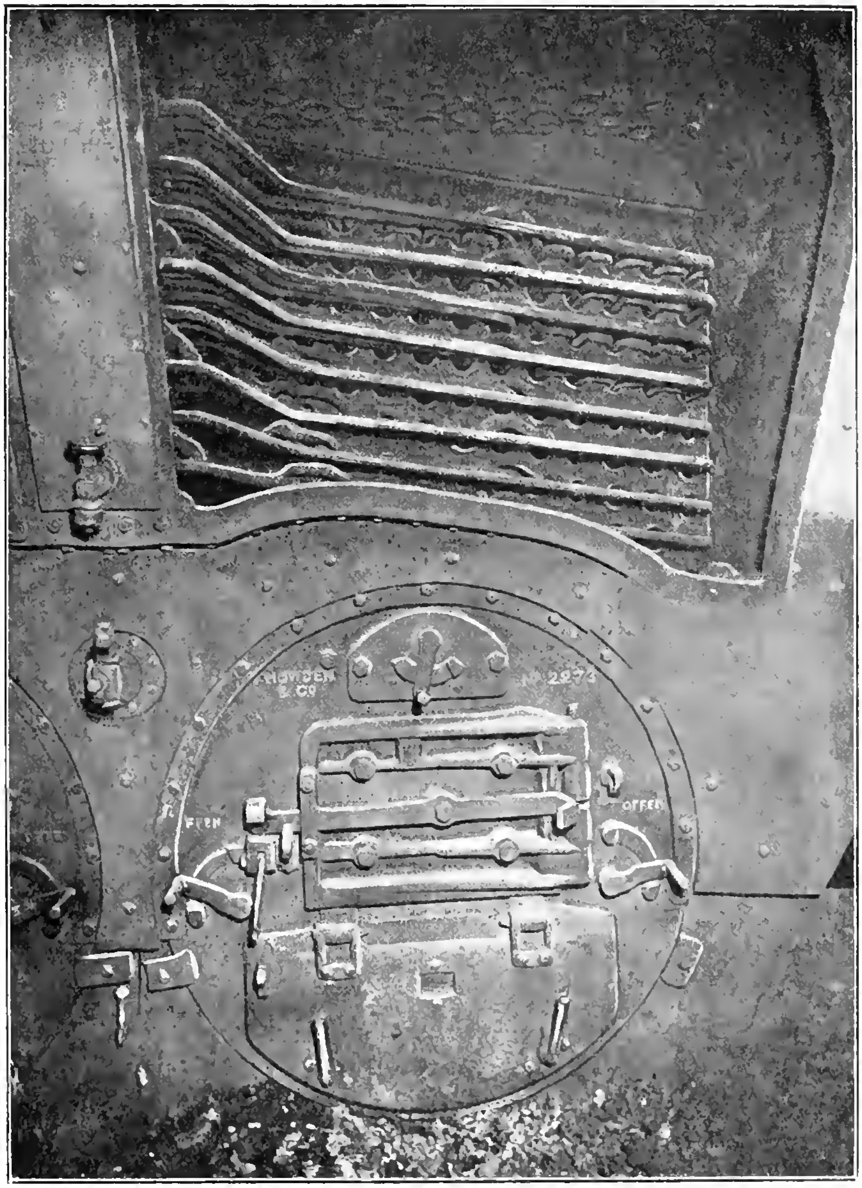


Fig. 2

With regard to the question of cleaning the boiler tubes, we were informed that this operation is quickly and effectively carried out by means of a steam jet.

one boiler being cleaned in about fifteen minutes. The simplicity of the system will be at once recognised, while the advantages to be obtained, due to the saving in coal, are very considerable, and as we understand this system has been installed in 262 steamers, including twenty now being fitted out, it would appear as if the early difficulties with superheated steam have been overcome.

The Association of Engineers-in-Charge.—This rapidly developing and useful Association held its fifteenth annual dinner at the Holborn Restaurant on Saturday, April 9th, when between three and four hundred sat down. The President of the association, Henry Adams, Esq., M.I.C.E., M.I.Mech.E., occupied the chair. The guests of the evening included the Right Hon. The Lord Mayor of London, Sir Alexander Kennedy, LL.D., F.R.S., Sir David Gill, the President of the Institute of Marine Engineers, Judge Rentoul K.C., among many others. Special reference was made in the speeches to the effort to revive the system of apprenticeship, in which the Lord Mayor has taken such a prominent part and shown such a lively interest. The growth and vitality of the Association is most marked, and we congratulate the executive most heartily.

Glasgow Technical College Magazine.—An excellent feature of student life in connection with this college is the varied nature of the sports and pastimes which engage the attention of committees of the students, organized for the general weal, and this issue of the College Students' Magazine contains much interesting matter, revealing details of the inner life of the students, and shows that a large number set themselves to the work of improving the time of their fellows, both as to the more solid business which called them together during the session, and the lighter occupations necessary to relieve the strain and the stress and tend to clear and broaden the mind. An article in one of the Glasgow evening papers dealing with technical education called forth a protest from the editor of the magazine in his retiring farewell notes, and doubtless the references made will help to reduce the swelled head of the student, who thinks he knows sufficient to overawe the practical foreman, who has built up his knowledge by experience, "learning through his finger ends" mostly. The reproach that students are crammed with "theory" is not justified here, as the laboratories and other accessories are largely made use of and are being extended year by year, while many of the students have served for periods at the practical work, some of them having completed an apprenticeship in the engineering or other workshop. The Students' Union, formed for social purposes, is about to take unto itself a house of its own, and in gathering funds together to this end, it is pleasing to note that past students—not forgetful of their own experience at the college—are contributing, while the Seniors who are about to leave for the outside world are contributing liberally—facts which evidence the popularity of the scheme and the excellent spirit which prevails towards their *Alma mater*. We notice that one paragraph in the magazine states that the College authorities give ear to the expressed views of the students and have shown the utmost readiness to meet these, a compliment to both, this seems to be, and speaks well for the spirit of harmony and good taste which rules. The Foreign Mail Bag of the magazine contains a letter from a Municipal Engineer, British Columbia, containing much excellent advice to young men in respect to Canada, but applicable to all countries. In reporting an interview with Prof. Mellanby, D.Sc. (Engineering) the motive power engineering department of the college is specially enlarged upon, and the excellent provision which has been and is being made for the engineering students is set forth, experimental machinery, laboratory, and other adjuncts of an up-to-date equipment. The desirability of chemistry for rising engineers' training is not only recognised but demonstrated in practical work in the laboratory and practical tests with machinery. A close connection between industrial work and college training is also fostered, so that hand in hand with the technical training, the value of such, in industrial enterprise, is impressed upon the student and his eyes opened to future possibilities.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Cunard Company.

Some disappointment has, not perhaps unnaturally, been expressed at the decision of the Cunard directors not to recommend the payment of a dividend for the working of the year 1910. Yet in the loss of the *Lucania*, one of the finest passenger steamships in existence, when she was lying presumably in absolute safety in dock in her home port, so strong a lesson as to the risks of the shipping business was conveyed to them, that it would be strange if the strengthening of their reserves were not even more fully impressed upon them than it has been in the past. Yet for years that policy of building up reserves and writing down the cost of the fleet has been pursued with the result that the company is now in a sound position with little, if anything, except modern tonnage. The gross receipts for the year 1909 touch the company's high-water mark, being £2,831,581, which is about £322,000 more than the figures of 1908. As £157,000 was saved in working expenses—largely owing to the reduced price of coal—the £50,000 which was taken from the reserve fund in the bad year—1908—is put back and with it another £30,000 is added to the amount. A huge sum, £376,000, is written off the book value of the fleet for depreciation. This compares with £297,000 in the previous year, and with £254,000 in 1907. But really as £100,000 extra has been specially written off the value of the new steamers in that year, the 1907 figure was not so far short of that for 1909. A sum of £66,000 is placed to the insurance fund. This compares with £6000 in 1908 and similar figures in previous years. But the increase here has been necessitated by the loss of the two steamers *Lucania* and *Slavonia*. Anyhow the gross profit of £660,000 is greater than in the year 1906 and 1907, when five per cent. dividends were paid, and thus there is sufficient promise that if things are reasonably good a resumption of dividend next year may safely be made.

Since the accounts were made up the *Umbria*, last of the single-screw mail steamers, has been sold out of the fleet. She goes to the East Coast of Scotland to be broken up by the Forth Shipbreaking Co. Her sister, the *Etruria*, it may be mentioned, having been dismantled in a Birkenhead dock, was towed round to Preston in mid-April for final demolition by Messrs. T. W. Ward & Co. The Company at the moment of writing is inviting tenders for another twin-screw intermediate steamer of about 18,000 tons gross register, to be a sister to the *Franconia*, now under construction on the Tyne by Messrs. Swan, Hunter & Wigham Richardson.

The Loss of the "Pericles."

Several important losses of steamships have occurred during recent months. But assuredly none have caused greater excitement than that of the Aberdeen White Star liner *Pericles* off Cape Leewin in the closing hours of the month of March. Here was the crack ship of a famous line, commanded by a ship-master of a reputation second to none, suddenly going to the bottom on a fine, clear afternoon in a place which must have been almost as familiar to those in charge of her navigation as the crossing at Piccadilly Circus is to the ordinary West End Londoner. The occurrence was graphically described by one of her saloon passengers who was engaged in some deck sports at the fatal moment. Suddenly there was a shock which was felt all over the 11,000-ton vessel. It was followed by a sound as of escaping steam. The vessel then lurched first to one side and then to the other, and every one knew that something serious had occurred. The ship was then—according to the master's story—which has since been proved to the satisfaction of the court of inquiry to be correct—some seven miles off the coast in the neighbourhood of of Cape Leewin. She was, in fact, in the course usually followed on such a voyage and she must have struck some unknown and uncharted danger. When her peril was realized she was at once headed for the shore. But the injuries sustained forward soon brought her down so much by the head that her propellers came up out of the water and further progress was impossible. The passengers and crew numbered no less than 450 in all, and these were rapidly and without accident transferred to the boats, which raced

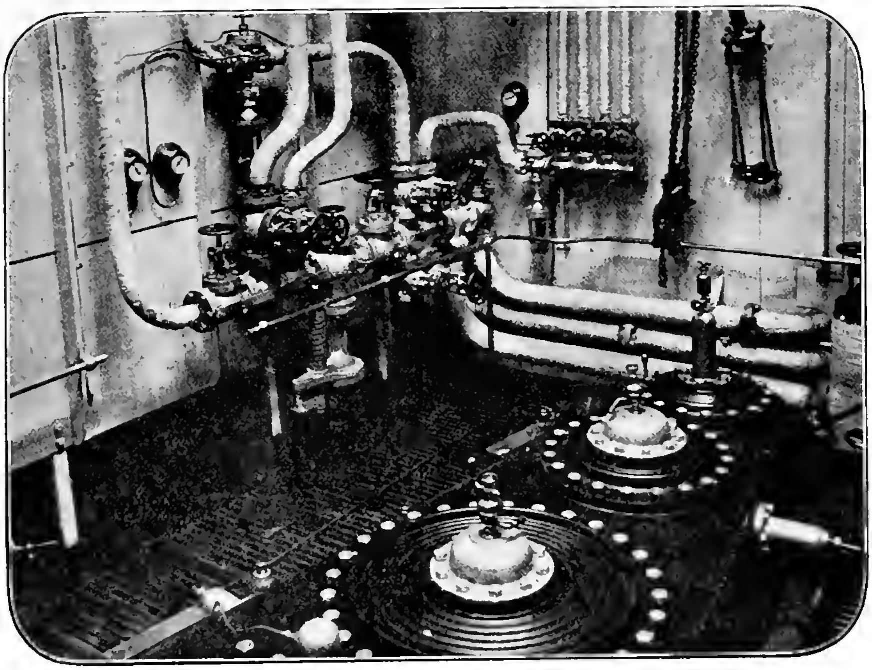
to the shore. The landing of all these persons on an open beach without loss of life or injury to limb is in itself a marvellous performance. But all concerned were Anglo-Saxons. How different this behaviour from that of the motley herd of poor class aliens from Eastern Europe, who totally panic-stricken tried to fight their way past the women and children to the boats when the *Cairnrona* explosion took place a day or two later in the Straits of Dover. It is stories like these that make one proud of the stock from which he comes.

The owners of the *Pericles* lost no time in taking measures to replace the lost vessel. Within a week of the disaster the further announcement was made that Messrs. Harland and Wolff, the builders of the lost ship, had received an order for a new vessel, of which the construction is to be pressed forward with all speed. The new ship is to be called the *Themistocles*, and will apparently be very much a repeat of the lost vessel. The value of the *Pericles* was fixed at £225,000 and at first it was believed that the cargo on board of her would be so costly as to bring up the total loss to three-quarters of a million sterling—a sum which would have surpassed that which was debited to the underwriters when the big American steamer *Dakota* was wrecked in the Pacific Ocean a few years ago. But as details of the shipments by the *Pericles* came to hand estimates were reduced and £600,000 seems more likely to be the total lost. So, too, the depth at which the wreck lay, it was at first believed, was not far short of 200 ft. But it was soon found to be no more than 16 fathoms, a depth which may allow divers to recover mails, passengers' baggage and possibly some cargo. The chances of raising the ship herself are, of course, remote, for the weight to be dealt with would be prohibitive, even were not the waters of the locality proverbially troubled. Moreover, the topmasts of the *Pericles* would assuredly rise more than 100 ft. above her keel. They evidently did not show above the water when she went down and the fact would seem to suggest that she may be lying on her side.

It was stated that the loss of the *Dakota*, to which I have referred, was the heaviest blow which has ever fallen upon the underwriters. I wonder whether this is a fact. Modern steamers are, of course, infinitely more costly than the craft of former days, and carry far larger cargoes. But Sir Thomas Sutherland, in his interesting speeches to P. & O. shareholders at their general meetings has loved to dwell on the good old days of shipowning when gold and silk and indigo were all the goods that the haughty steamship owner cared to cater for. Very heavy shipments of specie used to be made by the P. & O. and Royal Mail steamers of former days and it seems very probable that large sums may have disappeared in some more historical wrecks. Then we have the famous case of *La Lutine*, wrecked a century ago off the Texel with a vast treasure. And how did that compare with these present-day misfortunes?

The Channel Ferry.

As most of my readers probably know, a train ferry across the Straits of Dover has long been in contemplation, and for no less than five years the promoters have been in possession of Parliamentary authority to carry out their project. It is hardly necessary at this time of day to dwell on the advantages which a channel ferry would bring. Those of us who have stood on the platform of such a station as Ghent on an August afternoon and seen the expresses for various parts of the Continent rushing through one after the other with the passengers and mails disgorged at Ostend an hour previously from the Dover steamer, can gather some idea of the concentration of the boat traffic which would be secured by those who could collect all this business and despatch these through trains from a London terminus, instead of as at present from Calais and Boulogne, Ostend, Flushing and the Hook of Holland. What, then, stands in the way? It will hardly be believed, but the obstructions are the management of the South-Eastern and Chatham Railway, who decline to take up the big trump which has been dealt for their hand. Sir Charles Rivers Wilson, a former president of the Grand Trunk Railway of Canada, a man who has seen train ferries at work on the stormy waters of the Great Lakes of America, has now strongly taken up the advocacy of the British train ferry scheme, and has uttered a significant warning telling Dover plainly that if she will not accept the reform other ports will. What an opportunity it would be for the Great Eastern Railway whose management is one of the most enlightened in this country! Then Lord Brassey—who characterizes himself as an old sea dog—comes to the assistance of the South-Eastern Board and advises "the public to stick to the boats they have and not venture themselves in those steam ferries." As a man who has travelled much, Lord Brassey should have known the facts. Up and down the world there are scores and scores of these steam ferries in constant operation. The sleeping cars between the German and Scandinavian capitals are making use of similar conveniences every night of the year. Far longer voyages than that across the Straits of Dover are made by train ferries



The Schmidt System of Superheating (Page 376) Fig 3

long established on the American Lakes, where seas far more dangerous than any that arise in home waters may at any time be encountered. The bogey with which Lord Brassey would scare the timid and untravelled has been proved by long experience abroad to have no real existence. On the other hand, see the advantages to the passenger! On the run from London to Dover one is no sooner settled to read than one has to prepare to leave the railway carriage. Then there is the gathering up of one's small belongings, the fight down the unprotected platform to the steamer's gangway. The crowding on board, the struggle for a seat on deck or in the cabin, the rearrangement of impedimenta. Then comes Calais and a repetition of the discomfort of transhipment and again a train journey. The ferry would change all that. The through coach would give the traveller an uninterrupted rest and night journeys would be possible and even acceptable to ladies and children. Nor would London have the monopoly of convenience. Through coaches could even be run from great cities like Birmingham and Liverpool, Manchester and Glasgow. Nor would passenger traffic alone benefit. Costly and perishable goods would find the advantage of through transit and the avoidance of breakage by the elimination of the unnecessary handlings. Sir Charles Rivers Wilson is right. A channel ferry will come in spite of Lord Brassey and in spite of the reactionary railway board.

Wireless Telegraphy

seems to extend itself every day. The Marconi Company commenced its full and regular service between Europe and America at the close of April, and meanwhile Channel and Ocean steamers are constantly being fitted with installations. One of the latest Companies to adopt the appliance is the Wilson Line, which is fitting both its Atlantic and North Sea liners. The United States Government has gone so far as to introduce a bill into Congress whereby it is proposed to compel all passenger vessels to carry installations. Our own Government has been asked as to its intentions in this regard, and the reply has been given that at present it is satisfied with the way in which shipowners are adopting the device on their own initiative, the inference being that in this country legal compulsion in this matter appears unnecessary. So, too, the installation of

Submarine Bells

is making great headway. The Great Eastern Railway has just had its vessels fitted to make use of these safeguards, and the General Steam Navigation Company has also had one of its vessels adapted. Meanwhile it is stated that there are in use or in construction some 122 submarine bell stations in this country or abroad. Had there been an installation at the Bishops we had not had to deplore the stranding on the 18th April of the 13,000 ton Atlantic Transport Co.'s twin screw liner *Minnehaha* at Scilly.

The prospectus of

Elder, Dempster & Co., Ltd.,

came out at the beginning of April. The capitalization of the late Sir Alfred Jones's interests is put at £1,910,000, whereof £1,000,000 is debentures, £500,000 preference shares, £400,000 ordinary shares, and £10,000 management shares. The present issue is of £800,000 debentures and £400,000 preference shares, the remaining £200,000 debentures and £100,000 preference shares being taken by Sir Alfred's executor in part payment for his interests. The management shares are taken by the directors of the new Company—who are Lord Pirrie and Sir Owen Phillips. The ordinary shares, though not offered to the public, are subscribed for in cash. The great interest of the prospectus, however, appears in the holdings which the new undertaking acquires in existing Companies, and it may be well to place this on record:—

Name of Company.	Number of shares held.	Nominal Value. £	Proportion p.c. of paid up capital.
1. African Steamship Co., Ltd.	26,328	526,560	78
2. British & African S.N. Co., Ltd.	62,140	621,400	98
3. Elder Dempster Shipping, Ltd.	49,240	492,400	98½*
4. Imperial Direct West India Mail Service, Ltd.	24,896	248,960	99½*
5. Elders & Fyffe's, Ltd.	68,995	256,400	23
6. Cunard Steamship Co., Ltd.	10,049	161,200	10½
7. African Oil Mills, Ltd.	7,495	55,885	—
8. African Association, Ltd.	3,508	29,176	8½
9. Bank of British West Africa, Ltd.	12,633	40,756	—
10. Swan, Hunter, & Wigham Richardson & Co., Ltd.	4,010P / 20,283O	24,393	*

*In these companies there were also holdings of debentures.

In addition to these holdings in limited Companies there were twelve steamships of a gross tonnage of 32,943 directly owned by the firm. The firm had the management of ninety-seven steamships which, with the twelve vessels just referred to, brought the total of their fleet up to 109 steamers of a gross tonnage of 321,924 tons.

The business outside these includes properties in Liverpool, the West Indies, Teneriffe, the Canaries, West Africa, and Bristol. But details of these properties are wanting in the prospectus, though the total incomes for the last three years are afforded. The whole is an interesting resumé of the results of the late Sir Alfred Jones's business activities.

An Echo of the Russo-Japanese War

is seen in the report of the appeal to the Russian Supreme Prize Court in the matter of the British steamship *Hipsiang*, which was sunk by a Russian torpedo boat destroyer as long ago as the 16th July, 1904. The British Naval Court at Shanghai found that the master and officers of the lost steamship did the right thing under the trying circumstances in which they found themselves. The Russians, however, have decided that an alleged attempt to escape when called on to stop justified the action of their naval officers. Apparently those interested must rest content with this decision as the British Foreign Office now carries little weight in foreign chancelleries, and diplomatic channels are the only resource left.

THE INSTITUTION OF CIVIL ENGINEERS.—The students on April 29th paid a visit to Southampton Docks, and to Messrs. Harland & Wolff's engineering shops.

THE French battleship *Vergniaud* was launched recently. The *Vergniaud* is the last of the six vessels of the *Danton* class to take the water. The latter constitute a slight advance on the British *Lord Nelson* class, and the *Vergniaud* will have a displacement of 18,300 tons. She will have a speed of 19 knots. Her armaments will consist of four 12-in. guns, twelve 9·4-in. guns, and twenty-four lighter guns. She will carry 681 men, as against 800 in the *Lord Nelson*. One of the vessel's special features is the height of her guns above the water-line, which enables them to be fired under almost any conditions.

OLYMPIA.—As a place for exhibitions Olympia is kept well occupied, and the variety of the shows is wide, covering most of the interests which serve to draw audiences to inspect the goods and attractive features set forth. The Ideal Home Exhibition held in April drew a large number of visitors. Among the exhibits, which were well laid out and artistically arranged, were several to call for the scrutiny of the engineer apart from his duty to domestic matters. The need for lifts in large passenger steamers in order to minimise labour and facilitate daily routine work has been met by the manufacture of manual, steam, hydraulic and electric power appliances, and at the Exhibition the firm of Hammond and Chambers had some very neat lifts which were capable of adaptation to ship work. Electric heaters, irons and cookers have been greatly improved during the last few years, and the type of heaters and radiators shown by Rashleigh Phipps & Co. were well suited for saloons and cabins, artistic in appearance, giving good heat for the current used. Oliver Clark & Co. exhibited specimens of their special appliances, fire safeguards, electric current minimisers, transformers for use with their metallic filament lamps, radiators for small and large apartments or cabins. A large variety of vacuum cleaners were on show by several firms, those exhibited by the British Vacuum Cleaner Co. were specially worthy of note. These have been used very effectively for cleaning cushions in saloons and cabins by electric drive; the apparatus being hired out as wanted. In the annexe was a Tudor village with shops set out and the attendants in the costume of the period. The old-fashioned whipping post, stocks and ducking stool were on view, and the latter especially called forth comments from visitors which led one to think that the necessity for its service is not so obsolete as the apparatus is—a pity 'tis, 'tis so.

MODERN SHIPYARD MACHINERY AND EQUIPMENT.

III.

Iron-Working Machine Tools.

(*Continued from page 294.*)

THE frames to which the shell plating of ships is attached —whether of plain or bulb-angle bars, or of the Zed or Channel sections now more common in the huge ships of modern times—all require to be bevelled on their fore-and-aft flange to suit the contour of the ship's hull. The proportion of frames requiring to be thus treated is—as everyone connected with modern shipbuilding knows—a small part of the whole, where ordinary cargo-carrying ships are concerned, in which so much of the middle body is straight and parallel and of the "tea box" or "cast-iron tank" order! For the length of middle body the fore-and-aft and the transverse, or athwartship flanges are of rectangular formation, requiring no bevelling on the fore-and-aft flange, to make the angle either obtuse or acute. In vessels of fine fore body and aft body, however, there is a large proportion of the frames which have to be bevelled from the rectangular to the obtuse, or to the acute where vessels are of blunt or bluff contour.

The artizan skill, and the manual labour involved in accomplishing this alteration to the frame bars as obtained from the manufacturer have for many years, and to a large extent, been superseded by the angle bevelling machine, which is

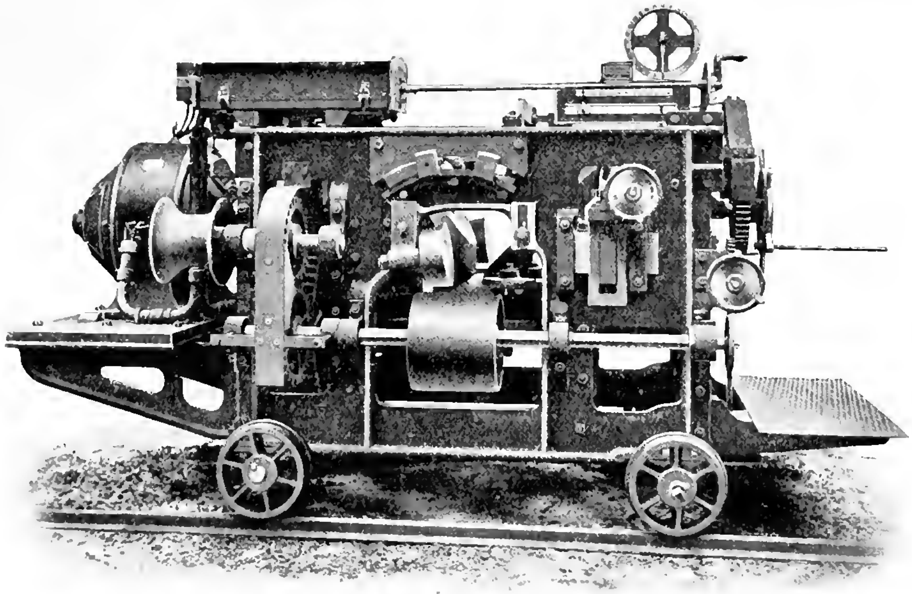


Fig 1.—Frame Bevelling Machine, electrically driven, by Messrs. Davis & Primrose, Leith.

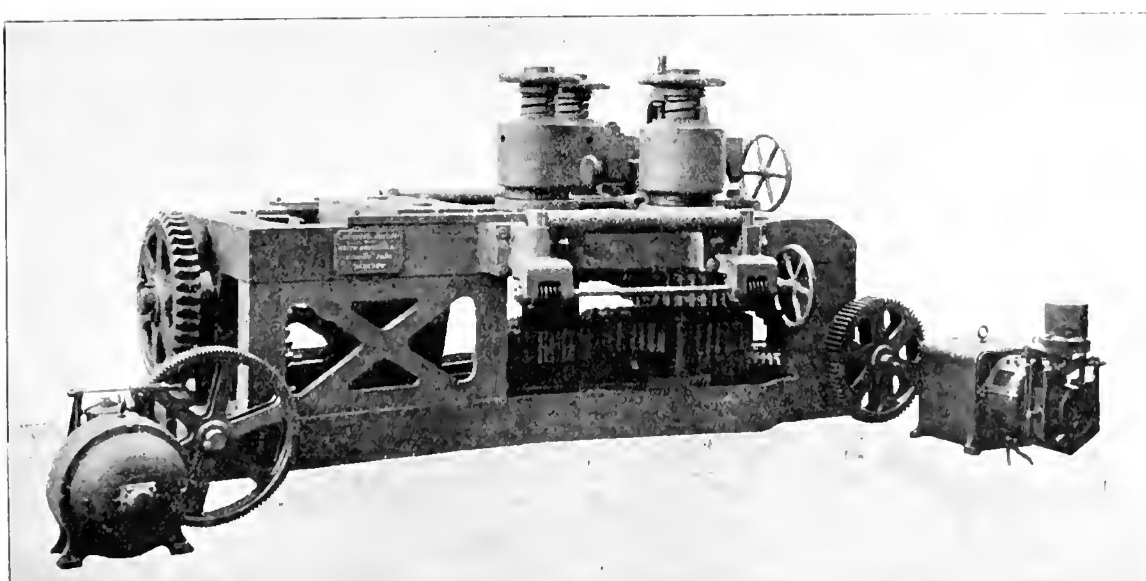


Fig. 2.—Arthur's Roller Curving and Straightening Machine, by Messrs. Smith Bros. & Co., Glasgow.

a feature of the furnace and bending block department of almost every modern shipyard in this country and abroad. This ingenious machine is made by Messrs. Davis & Primrose, of Etna Works, Leith, and an illustration is given herewith of the most modern type now made. The function of the bevelling machine referred to is, as previously stated, to alter the flanges of the framing to meet the formation requirements of the particular ship being built. The bars to be bevelled are drawn by iron cleats from the furnace in which they have been heated and are guided into the bevelling machine which traverses the front of one or more furnaces. As soon as the rollers of the machine grip the bar it is drawn through at a speed of 45 to 60 feet per minute and falls on the cast-iron floor (or bending blocks) whilst still very hot, and can be bent at once to the necessary curve of the ship's form. There are indices on the machine which indicate the degree of angle being given to the flanges and the particular point in length of bar that is being operated upon. The control of this arrangement is in the hands of the machineman in charge.

The illustration given herewith—Fig. 1—is of the latest arrangement of bevelling machine made by Messrs. Davis and Primrose, and represents their No. 2 size of machine, capable of dealing with sectional bars from 3 in. by 3 in. by ⅜ in. angles to 10 in. by 7 in. by 1 in. thick. It is driven by an electric motor, with sufficient resistance in the armature circuit, and a reversible controller lying horizontally. The starting handle is at right-hand end of machine, convenient to the man in charge who watches the indices, giving his directions at same time to his helpers who operate the bevelling roller by turning a hand-wheel. Recently the machines have been supplied with apparatus for moving the machine along the rails laid in front of the furnaces by electrical power.

For imparting the appropriate curvature to the incandescent frames when they have been drawn from the furnace—or when passed through the machine above described if they have required any bevelling—there is now in most shipyards, especially where the larger ships are built, a portable hydraulic frame-bending machine which supersedes hand-work. The machine referred to is the patented device of Messrs. G. B. Hunter & Copeland, and is manufactured by the Carville Engineering Co., Wallsend-on-Tyne. The tool is carried on two small wheels and is easily moved over the block floor, and applied to the frame wherever necessary. To resist the thrust of the ram, the base of this tool is provided with strong, short pins which fit into the ordinary holes in the blocks, and hydraulic pressure is supplied through a flexible pipe, which pushes the ram head against the frames, forcing them to take the desired curve. The celerity with which frames of any section, angle, channel or Zed, are set of the heavier scantlings of the larger ships of the present day, and the neatness of the work resulting, are matters which contrast most favourably with the labour and time involved in the old "hammer-and-hand" process. Through its use, it is estimated that there is a saving of 10 per cent. of fuel, 15 per cent. to 30 per cent. of labour, and an increased output of about 15 per cent.

The machines used in shipyards for bending and straightening beams and other bars, up till two years ago, were of the reciprocating push or squeezing description. In most establishments still, the machines for this purpose are of the same type, notwithstanding that there are not a few disadvantages attaching to their use. About two years ago, a new machine for accomplishing bar straightening and beam bending, in which the work to be done is effected by means of rollers instead of pushing arms, was installed in the Dalmuir Shipbuilding Works of Messrs. William Beardmore & Co. The machine referred to is Arthur's Patent Roller Bending Machine, the invention of Mr. Nicol S. Arthur, Glasgow, who was the original patentee of the frame-bevelling machine, which, in its improved form as now made by Messrs. Davis and Primrose, has been described above. The machine in the Beardmore Works has accomplished highly satisfactory work in connection with the heaviest, as well as the lightest, class of material involved in both naval and mercantile ships, but an improved form of the machine has since been produced and is at work in several yards in this country and on the Continent. The illustration herewith—Fig. 2—represents a machine in the works of the makers, Messrs. Smith Brothers & Co., Kinning Park, Glasgow. Later machines with improvements in detail have been installed in the shipyard of Scott's Shipbuilding and Engineering Company, Greenock, and in the Vulcan Works, Stettin, Germany, while at the present time a machine with all the latest improvements and driven by electric motor, is being completed for the firm of Blohm & Voss, Hamburg. This machine like one at Messrs. Vickers, Son & Maxim's works, Barrow, will curve cold beams for the protective and other decks of warships, of any section up to 13 in. deep. It will be driven by a 30-h.p. variable speed, reversing electric motor, a special motor of 10-h.p. being also provided for adjusting the rolls. Briefly stated, the advantages attached to the new type of bending machine are, the fairness with which bending and straightening is effected, the expedition and ease with which the work is accomplished, and the greater range of curvature possible by the machine without the need of any "furnacing" of the materials being operated on.

The reciprocating squeezer machines at present mostly in use do not set the bars to a fair curve, and fail to prevent the edges of the bars from buckling and twisting, and they must operate on each flange of the bar separately. The work they can undertake is limited to bars bent to large radii, such as ship's deck beams; bars which must be curved to smaller radii requiring to be heated in a furnace. The reciprocating motion of these machines entails much loss of time between the squeezes, while the bars also require to be pushed through the machine by manual labour, and they receive an impression only at intervals, which causes flat parts—more or less unsightly—in the curve. Moreover, the edge of the bar is apt to be indented with the sharp face of the squeezer. In the Arthur bender, on the other hand, the rollers produce a fair curve, as every inch of the bar is subject to the same pressure, and the machine is self-feeding. Instead of several men requiring to push or pull the bar through, as in the case of the squeezing machine, between the blows of the squeezers, the three rollers driven at the same speed assures self-feeding and travels it along, thus saving time and labour.

From the illustration given, it will be gathered that the machine consists of a strong entablature, having three projecting vertical cast-steel rollers, carried on strong forged steel spindles. The work is bent between the two back rollers, and the front and bending roller. The latter has fixed bearings, and the two back rollers have a radial adjustment to suit the various depths of angles, beams, etc., being treated. The rollers have bottom flanges slightly above the table level, upon which are fitted cast-steel sleeves, vertically adjustable by screws and hand wheels, by which they can be lowered close to the roller flanges or raised to form recesses for receiving any given thickness of beam flange. The action which adjusts the back rollers for deeper beams, etc., also increases the distance between the centres of these rollers in the correct proportion for the depth of section being treated. By the arrangement of gearing, all the rollers are concurrently driven, which ensures an absolute feed. The two back rollers, with their spindles, are carried in quadrant links made of steel, with steel tension links for their adjustment. This is effected by a square-threaded screw carrying a nut-block operated by hand wheel or by motor, at the end of the machine, the back rollers being quickly adjusted to their work whilst running and bending. The roller spindles run in broad gun metal bushes, adjustable where practicable. Two horizontal rollers, one on each side of the machine, and adjustable vertically, are provided for carrying the work and controlling the vertical flange of the bar being operated upon. To prevent the bar twisting, buckling or travelling out of line, the edges are made to run in a groove, formed by the space already described between the sleeve and the bottom lip of the rollers. These sleeves can also be used to grip the edge of the lighter bars, so as further to ensure proper feed through the machine.

In the case of bars having two flanges, such as channel—or Z—bars, each flange, when the work is done by the squeezers, requires to be straightened or curved separately. When curving one flange there are no means of preventing the vertical flange from twisting or bending, nor the edge of the flange being curved from buckling. Time and power are thus wasted, for instead of the force going to curve the bar it is partly spent in buckling and in bending the wrong flange. As each flange requires to be treated separately, frequently a flange has to be gone over a second time to make a fair job. The sleeves of the bending roller and the side

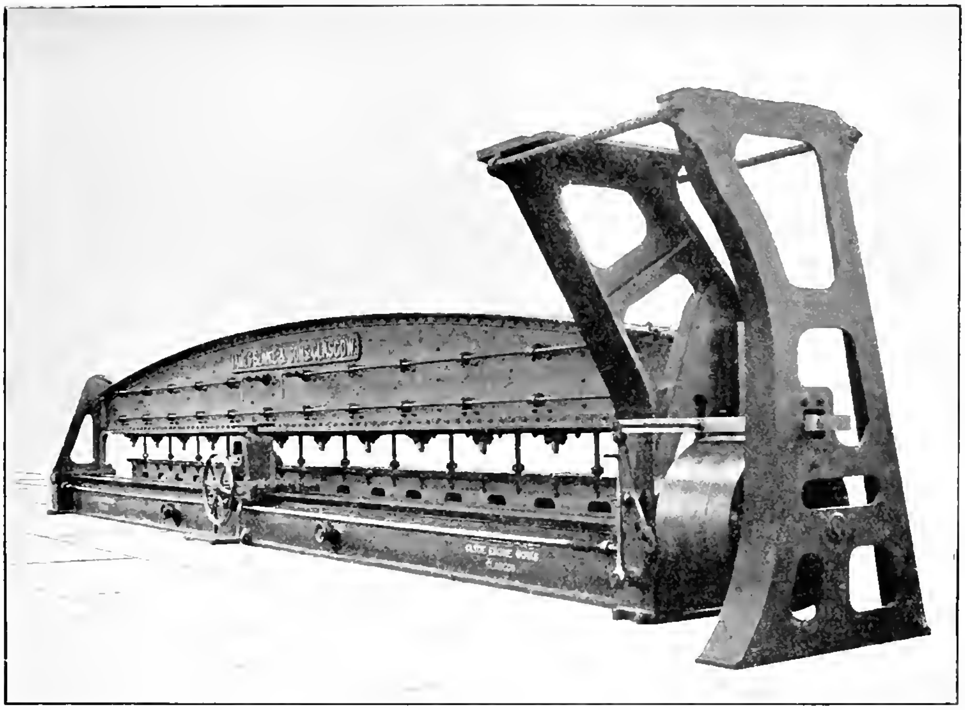


Fig 3.—Heavy Plate-edge Planing Machine, by Messrs James Bennie & Sons, Glasgow.

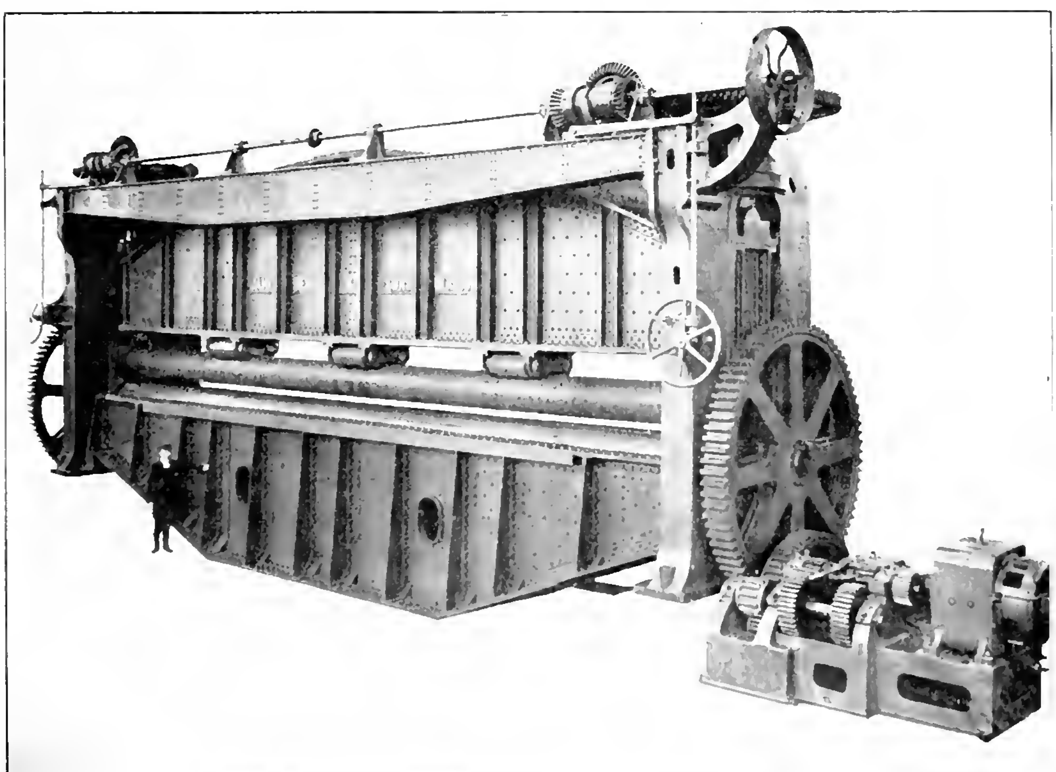


Fig 4 Heavy Plate Bending Machine, by Messrs. James Bennie & Sons, Glasgow

guide rollers are designed to prevent buckle and twist. The inside edge of the bar is confined freely to allow for expansion between the lip of the fixed centre roller and the sleeve, thereby preventing the buckling tendency, while the vertical flange of the bar is controlled between the centre heel roller (this centre heel roller is in line and level with the lip of the centre roller; both are kept ¼ in. higher than the lips of the side bending rollers, so as to allow the vertical flange of the bar being curved downwards to counteract the tendency to bend upwards) and the sleeves of the two side bending rollers, thereby preventing the vertical flange of the bar from rising or twisting upwards from the heel as in the case with all angles when being bent. Where the vertical flange of the bars inclines downwards the side guide rollers are adjustable to counteract this, so that full command is had of the vertical flange of any bar, at the same time that the horizontal flange is being curved. In other words, with the roller bending machine, the bar is not only curved in one half the time, but with the same operation the deck flange is straightened, thus adding a further saving in time and labour.

In order to cope with the very long and heavy plates now employed in the construction of modern vessels, machine tools concerned with planing, bending, shearing, and punching are now being made and supplied of unusual size and power. The growing use of high-speed tool steel and the extending application of electric motor driving are also conditions which have imposed and make possible, this line of development. Striking examples of the heavy calibre machine tools referred to are given in some of our illustrations. Fig. 3 represents a plate-edge planing machine of most unusual capacity and power, made by Messrs. James Bennie & Son, Cardonald, Glasgow, and installed into a number of naval yards, and in private yards where the largest ocean liners are built. This fine example of the type of tool which modern requirements demand is designed to plane at one stroke the edges of nickel steel plates 36 ft. in length and 1½ ins. in thickness at a cutting speed of 40 feet per minute. The rigidity of its construction, and the power of its gearing enables the tool to take enormous cuts at the speed already indicated. The wearing surfaces are all of unusually ample character, and the whole tool bears evidence of careful design effectively applied. The tall frames on either side of the belt pulleys are designed to carry the electric motor for driving the machine.

Another striking example of the type of tool now being built and supplied to cope with the very long and heavy plates involved in the construction of modern vessels is afforded by Fig. 4, which illustrates a large plate-bending machine, also by Messrs. James Bennie & Son. This tool is of sufficient power and capacity to bend a nickel steel plate 36 ft. in length and 1½ ins. in thickness. The main driving gear is actuated by direct geared electric motor, and the upper gear for adjusting the elevation of the top roller and beam is driven by motor through belt. The enormous size of the girders, and the power of the gearing suggests the heavy duty required of the machine.

The double-punching machine with side shear illustrated by Fig. 5 is one of the many recently supplied by Messrs. Bennie & Son to the British Admiralty and to shipbuilding firms engaged upon naval work. The design is massive, compact and simple, and embraces all the most modern ideas relating to the reduction of friction and the increase of efficiency. These machines are being installed with capacity for punching and shearing nickel steel plates from 1½ ins. to 2 ins. in thickness, and having punching gaps 48 ins. in depth, are thus fully capable of overtaking all the punching in plates of the largest width now employed.

(To be continued.)

MESSRS. MATTHEW KEENAN & CO., LTD.—We have been informed that this firm has recently secured the contract from H.M. Office of Works to cover the whole of the boilers, calorifiers, steam pipes, etc., at the new General Post Office, King Edward VII. Building, in Newgate Street, with their non-conducting composition. In addition to the foregoing the firm is working at high pressure on orders in hand at both its London and Glasgow works. Agents have been recently appointed in Australia, New Zealand, South Africa and Antwerp, and they report that users of Keenan's composition are extremely pleased with it.

INSTITUTE OF MARINE ENGINEERS.

A VISIT was paid by the Institute of Marine Engineers on Saturday, April 16th, to see the stage machinery at the London Coliseum, when a large number of the members availed themselves of the opportunity. The stage manager, Mr. Henry Crocker, very kindly conducted the party round and explained the various items of interest.

The enormous stage, the largest of its kind in the world, extending 90 ft. to the rear from the proscenium, was the first part visited. The floor consists of three concentric revolving tables, the inner table being about 25 ft. in diameter and the outer 72 ft. 6 in., with a clearance of not more than one inch. The outer table is capable of being revolved at a speed of about twenty miles an hour; such high speeds, however, are only required on rare occasions, the ordinary utility of the arrangements being that the scenes may be changed without loss of time. While one performance is in progress the scene for the next is being prepared ready to be swung round into position on the fall of the curtain. The preparation of these scenes is no light matter, and in some cases has to be ganged to within one-eighth of an inch in a proscenium width of about 55 ft.

The stages are rotated by means of fourteen 14-h.p. motors, controlled from a platform at the side of the stage. On descending below the stage the controllers which are of very large size, were shown, also a series of "dimmers," by means of which the lights throughout the building may be put out gradually. Underneath the stage itself was seen the framework of the tables. Each of the three sections is supported by a steel framework connected to a circular girder. The girder carries two rails, one on the under side and a guide rail on its external circumference. The table and rings are kept in place by rollers which bear at intervals against the guide rails, the lower rails resting on a number of idle rollers, between which are live rollers driven by electric motors. The live rollers are held upwards against the rails by strong helical springs, so that a friction drive is obtained. Each of the three stages may be driven independently, or they may be locked together and the whole stage made to revolve, the total weight of the stage being 160 tons.

The party afterwards made the ascent to the "flies," situated about 40 ft. above the stage level. What seemed to be a complicated tangle of ropes and tackle was here being manipulated to provide the various drop scenes, etc., but it was soon observed that the arrangement was quite simple and methodical, the scenes being placed at regular intervals of about 1 ft., the ropes and raising and lowering apparatus being well defined for each. In view of the constant necessity of changing the positions, these are worked by hand, although there are several machines for heavier work. There are also three hydraulic machines for the fireproof, tableau and act curtains. A few of the party made a further climb of about 30 ft. up to the "grids," where the mechanism of the tableau curtain was seen. This consists of a large drum, from which two ropes descend to the opposite corners of the curtain; a pull on the "jigger" rope causes the drum to rotate, either for dropping or raising the curtain as required.

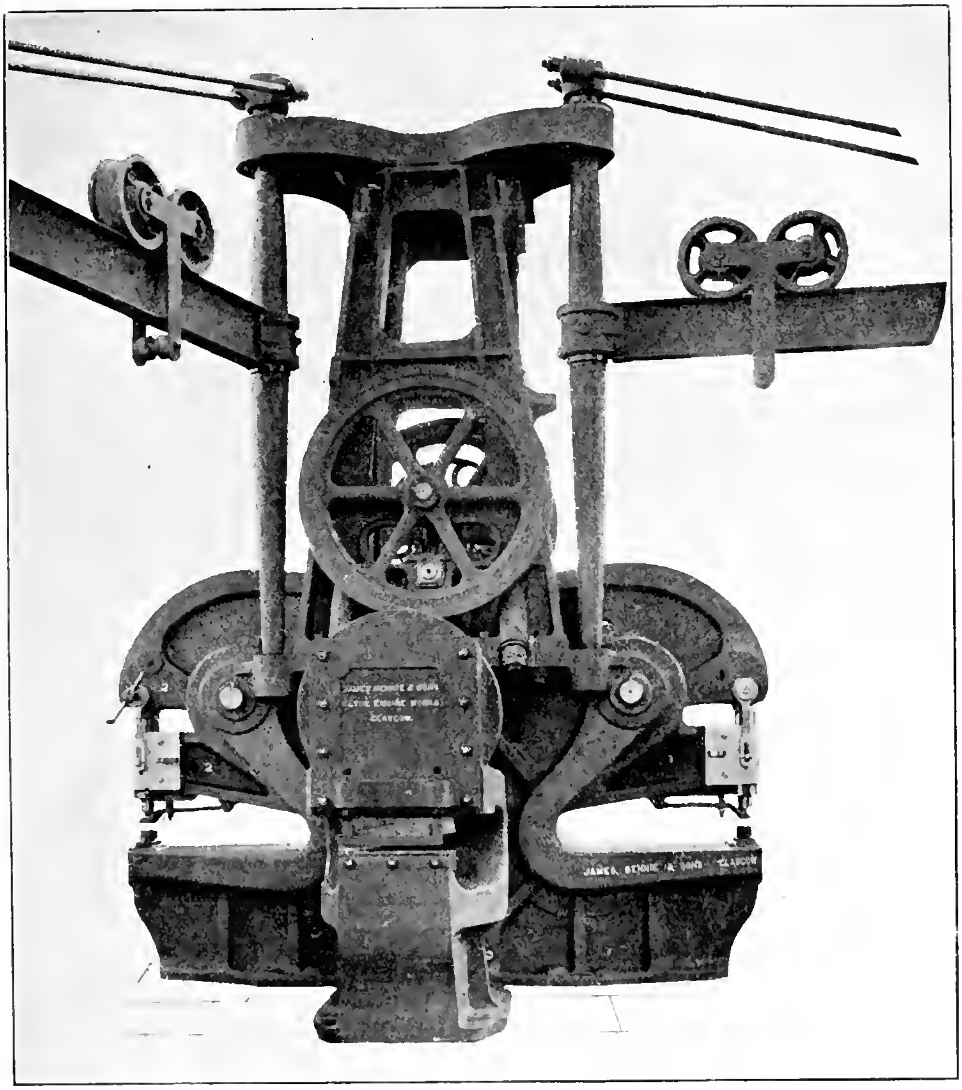
A move was then made to the platform from which the stages are driven. There are three pillars, for the inner, middle and outer tables, each with the necessary levers to rotate it at different speeds and in different directions, the orders from the stage manager being transmitted by a form of engine-room telegraph. The switchboard is situated on the same platform a little distance from the driving apparatus. It contains about eighty-five distinct switches, some interlocked or fitted with automatic devices which reduce to a considerable extent the work of the operator. There are about 6000 lamps in connection with the stage and the adjoining rooms, and those of the auditorium bring the number up to about 8000 in all. In order to avoid risk of failure there are two separate installations, supplied with current from different companies.

A performance being in progress at the time of the visit, an opportunity was afforded of seeing the various parts in actual work, and the rapid building up and dismantling of the scenery, the rotations of the stage, dropping and raising of curtains, etc., proved of great interest.

MARINE BOILER EXPLOSIONS.

From the Board of Trade Reports.

REPORT No. 1900 deals with explosion from the boiler of the steam flat *China*. The explosion occurred on the 9th December last, on board the steam flat *China*, at No. 1 branch, Alexandra Dock, Bootle, Liverpool. John James Stephens, an employee of Messrs. Kerr & Co., was slightly scalded about his face and hands. The boiler, which is made of steel, is of the ordinary marine type, 5 ft. 6 in. in



Modern Shipyard Machinery (see page 381) Figure 5
Plate Punching and Shearing Machine by Messrs. James Bennie & Sons, Glasgow

length by 6 ft. in diameter. The third tube in the third row of the starboard group failed about 8 in. from the combustion-chamber end, the hole being at the top of the tube, and measuring about 4 in. in length by about $\frac{5}{16}$ in. in width, through which the contents of the boiler escaped into the stokehold. The explosion was due to the thinning of the tube, by corrosion, to such an extent that it failed at a pressure considerably less than the working pressure of the boiler. The observations of the Engineer Surveyor-in-Chief are as follows :—The tubes in this boiler were much worn, and one of them burst, causing injury to one of the men on board. The owners had been advised by the insurance company, at the previous annual inspection, to have a few tubes withdrawn for closer inspection at the next examination of the boiler. As, however, the boiler had done but little work during that time, the owners appear to have been of opinion that the condition of the tubes would not in consequence be much changed. In this view they were mistaken, and it might be here stated for the owners' information that many boilers wear out more quickly by intermittent and irregular working than by being constantly used. Further, they would be well advised in future to give serious consideration to recommendations made to them by insurance companies with whom their boilers are insured. The insurance company's inspector had again made his annual inspection of the boiler internally, and steam was being raised for him to see the boiler under pressure when the explosion occurred. He had not, however, at that time communicated the result of his inspection to his company, nor had he further warned the owners in regard to the condition of the tubes.

Report No. 1902 deals with the explosion from a boiler on board the steam trawler *Balmoral Castle*. The explosion occurred on the 6th January last, when the vessel was at the fishing grounds, about 45 miles E.N.E. of Aberdeen. No person was injured by the explosion. The boiler is of the single-ended marine type with two furnaces, and is made of steel. A crack, which measured externally about 13 in. long,

occurred at the knuckle of the front flange of the starboard furnace. Through this crack the water and steam escaped so rapidly from the boiler that the attendants were unable to draw the fires, or stop the engines until the boiler had become empty. The engines were meantime stopped, by shutting the stop valve on the top of the boiler. When it became possible to make an examination, it was found impracticable to effect any repairs and, after drifting for $2\frac{1}{2}$ days, the vessel was picked up and brought to Aberdeen. The explosion was caused by the development of a crack, beginning at the inside of the plate, which, owing to the movements of expansion and contraction, acting over a lengthened period upon a furnace of somewhat rigid design, gradually extended until it penetrated the plate. This explosion is of a similar character to that which occurred in the port furnace about two years ago and was dealt with in Report of Preliminary Inquiry No. 1728. The failure of the port furnace was attributed to deficient flexibility, having regard to the frequent fluctuations of temperature in the furnace, and the present case appears to confirm this view. It may be mentioned, in addition, that the furnace flange is made with an unusually short radius. The observations of the Engineer Surveyor-in-Chief are as follows:—This report deals with a second explosion from this boiler, of an exactly similar nature to the first, showing conclusively that the necessary expansion and contraction in the vicinity of the furnaces is not sufficiently provided for. The radii of the flanges of the furnaces are said to be unusually small, and there is no doubt, that had the curvature been greater, it would have provided more effectually for the movement of the plates under the varying changes of temperature.

Report No. 1904 deals with the explosion from a main steam pipe on board the s.s. *Australind.* The explosion occurred on the 16th August, 1909, when the vessel was on a voyage from London to Fremantle, Western Australia. No person was injured by the explosion. The pipe which failed was the main steam pipe, connecting the stop valve chest on the centre main boiler to the junction piece on the main engine regulator valve chest. The pipe was made of copper, solid-drawn, $5\frac{3}{4}$ in. in bore and No. 3 S.W.G. thick. The ends were fitted with flanges brazed on in the usual way. The pipe fractured circumferentially, close to the flange bolted to the boiler stop valve chest. Part of the fracture, which extended for $15\frac{1}{4}$ in., ran under the brazing. The boiler pressure at the time of the explosion was about 190 lbs. per square inch. The explosion appears to have been due to the inability of the pipe to withstand the stresses caused by the vibration of the engines and the expansion of the pipe. The observations of the Engineer Surveyor-in-Chief are as follows —This report records another instance of a copper steam pipe failing on account of its form being unsuited for withstanding the stresses to which the material was subjected under ordinary working conditions. The pipe has now been modified, and with the greater flexibility afforded by the additional bend which has been introduced, it is hoped that a recurrence of the trouble will be obviated.

LONDON DOLLAR ACADEMY CLUB.—Mr. Alex. Izat, C.I.E., presided at the annual dinner on April 22nd, when there was a good attendance of members, among whom were Sir David Gill (president of the Institute of Marine Engineers) and Mr. John Wilson (recently retired engineer, Great Eastern Railway Co.). After the loyal toasts had been duly honoured, the secretary, Mr. John Knox, submitted his report. The toast of the evening, "The success and prosperity of the old school," was then proposed by the Chairman, who recalled to the memories of his school-day contemporaries, reminiscences of forty to fifty years ago; many of these had, like himself, spent half or more than half of the intervening years in India and the East. Mr. C. S. Dougall, M.A., in responding, stated that the old school was still maintaining the traditions which clustered around it, the successes of more recent former pupils being cited as evidence. The capital left in 1802 by the esteemed founder, John Macnab, remained untouched, and the additions and improvements made for both the girls' and boys' departments were paid for out of revenue and by donations from former pupils, several of whom had contributed liberally. The most recent extension was a large laboratory for science and physics.

THE COLLISION BETWEEN THE S.S.'s "ONDA" AND "LA SEYNE."

OUR readers will remember that about five months ago a serious collision took place off Singapore Harbour between the British India s.s. *Onda*, of 5,247 gross tons, and the French liner *La Seyne*, a vessel of 2,379 gross tons, owned by the Messageries Maritimes de France.

View showing damaged bow of the *Onda*.

The collision occurred at 4 a.m., and the illustrations which we publish show the effect of the collision on the bow of the rammed vessel, the *Onda*. The *La Seyne* is an old vessel which was used for the first time as the Khedive's yacht at the opening of the Suez Canal. She sank in two minutes, with the result that the bulk of her passengers, who were below and asleep at the time, were drowned, owing to the rapidity with which the vessel sank and the hour at which the collision occurred. The look-out man and the officer of the watch of the *La Seyne* were both drowned. The photographs clearly show the point of impact of the ramming vessel and the immense damage done to the bows of the *Onda*. It was wonderful that she was able to reach the Tanjong Pagar docks at Singapore, where the photographs were taken. The writer saw the plates which had been taken off her damaged

bows lying in a heap on the quay, and their torn and bent shapes bore eloquent testimony to the violence of the collision.

It is a credit to British seamanship that the accident boat of the *Onda* was *in the water* before the *La Seyne* had sunk, and it must be remembered that these boats of the B.I. line are manned by Lascars with European officers.

It is a matter of remark that the night at the time was fine, and consequently the cause of the disaster all the more inexplicable. The fact that the *Onda's* accident boat took the water so soon after the collision shows conclusively that good watch was kept on board her. The court of enquiry found the *La Seyne* to be the direct cause of the collision.

Another view of the damaged *Onda* after collision with *La Seyne*

Clyde Engineers' Working Week.—The points in dispute between the Clyde District Engineers and the North-West Engineering Trades Employers' Association with reference to working hours, were fully discussed at a central conference held on April 15th at York. The Clyde engineers, it may be recalled, pointed out to the employers the number of centres in the country which were now working fifty-three hours per week for their fifty-four hours' pay, and asked to be placed on the same footing, but the employers declined on the ground that they were hampered by higher prices of material, freight rates and unfavourable weather conditions. After a sitting lasting about eleven hours, it was intimated that there would be no official communication, but that a memorandum on the various points discussed had been arrived at and would be submitted to the employers and the men in the different localities in the usual way. It was understood that certain definite concessions had been granted by the employers.

IMPROVED APPARATUS FOR WARPING, WINDING, HOISTING, ETC., ON BOARD SHIP.

The utilization of electrical machinery on board ship differs entirely from that of electrical machinery on land. A considerable amount of electrical machinery for marine use must be capable of developing its full power even whilst turning a half somersault. Deck or exposed electrical machinery must be capable of doing all sorts of diving performances without being any the worse. Also it must be able to withstand long periods of dampness and probably of disuse under the most unfavourable conditions, and yet be capable of starting up at any instant. The starting and controlling apparatus must be of the simplest character possible, so simple, in fact, that the ordinary deck hand could control the deck electrical machinery, even though he had never seen the machine before. Any one designing electrical machinery for marine work must take into consideration many points never required in the design of electrical machinery for use on land.

If we except the steam turbine we may consider present day marine machinery as slow moving. During the past few years the average speed of nearly all types of land machinery has increased by leaps and bounds. The reason for this is obvious. By doubling the speed of a machine we may expect double the power from the machine whilst the weight, price and size remain unchanged. Only the other day I had the opportunity of seeing three prime movers of nearly the same power, but of vastly different dates. To make the three more interesting I might point out that they were situated within two miles of the place where Watt made his first engine. The first was an old atmospheric condensing steam engine making

*Read at a meeting of the Institute of Marine Engineers on Monday, March 21st, by Mr. Jas. A. Liddle, of Edinburgh.

thirty to forty strokes per minute, weighing several tons, and with its guide rods, levers, etc., occupying about 15 ft. by 15 ft. by 20 ft. This engine has no doubt some advantages, for instance, a man might wrap a cloth round his hand, lift off the safety valve, and have a peep into the boiler, without stopping the engine. The second prime mover of interest was a De Laval steam turbine running at something like 20,000 revs. per minute, and weighing a few cwts., and occupying a few cubic feet. The third was an electric motor running at 1500 revs. per minute, weighing a few cwts., and occupying a few cubic feet.

No shipbuilder of the present day would dream of building a ship and fitting it with atmospheric condensing engines, because the ship would not be capable of carrying sufficient engine power to drive her at a reasonable speed, far less able to carry a cargo in addition. As we step up the ladder of improvement we fit ships with high speed, light machinery giving them greater carrying and greater earning capacity. This is pretty much the case so far as the engine-room is concerned, but during the past twenty years there has been very little improvement in auxiliary machinery. Looking at the deck of a large cargo steamer, one is very much surprised that owners are content to send their ships out with such cargoes of deck machinery. Strength, efficiency and reliability do not lie in weight and build, but in design.

In regard to ship auxiliary machinery, there are at least four different efficiencies to be considered. There is the mechanical efficiency of the machine in question. This is the first important point for land work, but in marine work the mechanical efficiency is of no importance if the machine does not possess other high efficiencies, such as, weight divided by power and volume divided by power; reliability, first cost together with annual expenditure, interest, sinking fund, upkeep, and insurance. All these and possibly several other efficiencies or properties have to be linked together. Even if a piece of auxiliary machinery having to the highest degree all the before enumerated properties was procurable, superintendent engineers and shipowners have great difficulties to overcome before introducing these on board ship, because the majority of sea-going engineers have only a knowledge of the steam engine and its characteristic properties. If given an internal combustion engine or an electrical motor they would subject it to the same working treatment as they would a steam engine. I hold that the designer of internal combustion engines and electrical machinery must meet superintendent engineers and shipowners half way. As probably most of the members have read Mr. McLaren's paper on "The Extended Uses of Electricity on Board Ship," I will not touch on the high transmission efficiency to be effected by making use of electrical power instead of steam power for driving auxiliaries on board ship. However, matters must be considered from all points of view. For instance, a De Laval steam turbine *of itself* has a very high efficiency, but if coupled direct to a ship's propeller, the combined efficiency will be very, very low, therefore, notwithstanding its high efficiency, the De Laval steam turbine must be passed over. Similarly with electric motors; a well designed electric motor should give an efficiency somewhere between 85 per cent. and 90 per cent., but unless it can be coupled to a machine in such a manner that it gives a good combined efficiency from every point requiring consideration for marine work, it must be discarded as useless. From a theoretical point of view, the power which an electric motor will develop depends entirely upon its speed and temperature rise. In the design of electric motors for marine work, these are two very important quantities to be fixed, because if there is no limit to speed and no limit to temperature rise we may design marine motors as small and as light as we please. Taking temperature rise first; the size and weight must be controlled by the class of insulating material at our disposal, but for present-day practice no part of a motor should be allowed to heat above 90 degrees Centigrade. Now what determines the motor speed? The rotating agents present in an electric motor are lines of magnetic force acting at right angles to electric current. As neither of these has any wearing-out effect upon the materials through which they pass we lose nothing and gain everything by increasing the speed of the motor. However, as no person has yet been able to invent a means whereby two elements may rotate relative to each other without bearing or friction, our motor speed becomes limited from bearing friction. Then in continuous current motors we have the brushes and commutator. Experiment has determined that to give good commutation the commutator speed must lie between 2000 ft. per minute and 3000 and nearer 3000 than 2000. Thus, if we want high spindle speed the diameter of the commutator must be small, and above certain speeds it becomes impossible to construct the commutator to give satisfaction. With speeds up to about 2000 revs. per minute on sizes up to, say, 50 h.p. there is nothing in commutator or bearing design to prevent good results. In alternating and continuous current motors we have to reckon with centrifugal force, but the main factor in determining the speed is the transmitting agent which connects and links up our speed spindle to the machine to be driven. It is here we are brought face to face with the problem which, if solved, will save 75 per cent. to 100 per cent. compared to the present methods of working auxiliary machinery. There is a general impression abroad among builders of winches, capstans, hoists, etc., that slow speed motors are essential. Certainly, if resistances or controllers are used to regulate or adjust the speed, slow speed is essential, because a continuous current motor which has its speed varied must have a variable commutator speed, and no design can allow of a great variation of commutator speed without injurious sparking at the brushes. Therefore, motors used in conjunction with controllers must be of slow speed, and even then the commutation and sparking cannot be entirely avoided. Further, the use of resistances or controllers for regulating the speed entails a waste of energy, and every motor fitted with a controller must be considerably larger and heavier than one without.

For many reasons I would not use any means of controlling the motor speed. What I would propose for continuous current, is a compound wound motor fitted with commutating poles. The motor would, of course, be designed for constant speed. Such a motor can be made to run absolutely without sparking on any load and under any variation of load, no matter how sudden. I have had a motor as described running at 1700 revs. per minute, doing regular work for seven months without having the commutator or brushes looked to. The motor in question works on variable load and is very often severely over-loaded. With high speed continuous current motors, properly designed commutator and brushes have no particular drawback.

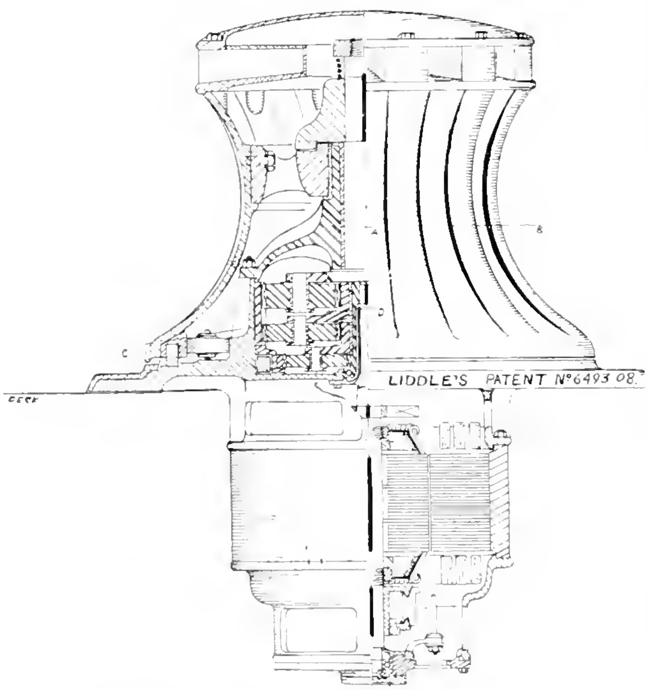
Squirrel cage, three-phase, alternating current, high-speed motors meet my ideal design for use with capstans, winches, etc., on board ship. With the system I propose the three-phase squirrel cage motor would require absolutely no attention from the ship's engineers. The only examination it would require would be at the time of the ship's annual overhaul. Whether the system adopted be continuous or alternating current I would not make use of any electrical speed control on the motors, because, when an electrical speed control is brought to act upon a motor, the size and weight of the motor must be considerably increased, and again high-speed motors do not lend themselves to speed control. My design so far has been to get rid of superfluous weight and volume, and if I bring in electrical speed control I immediately lose what I have tried to gain. Considering the present electrical qualification of sea-going men, supplying an electrical motor with a variable speed control means that the motor will in all probability be standing at the moment when it is most required. All electrical contact systems, hot wires, etc., have a certain amount of unreliability about them, especially if used in various climates. I find even with men on shore, who have far more opportunities of learning how to detect electrical faults than men at sea can have, they will blame the motor for being burnt out or the like, when the fault may only mean a broken wire in the controller which could be repaired in an instant if the man had the ability to find it. Thus there are six distinct gains to be effected by the use of high-speed motors without electrical speed control.

1st, the weight divided by the power gives high efficiency; 2nd, the volume divided by the power gives high efficiency; 3rd, the power turned out divided by the power put in gives high efficiency; 4th, reliability; 5th, small cost of upkeep; 6th, low first cost.

With continuous current motors of all sizes above, say, a quarter-horse power and alternating current squirrel cage motors above, say, five-horse power some form of starter must be used to check the current until the rotating part of the motor gets up sufficient speed to protect itself. Wire starters have some of the drawbacks shown in wire controllers, and we

are again faced with the difficulty of unskilled operators, therefore I propose dispensing with the ordinary motor starter which is generally constructed of wires and sliding copper contacts. In ship work the resistance wires when heated quickly oxidize and crumble away, and are a source of constant trouble. The sliding copper contacts when used with insufficient care become burred and burnt at the corners, and thus tend to stick. When left idle for some time they become encrusted with verdigris which prevents good contact. I dispense with sliding contacts altogether, in fact I do away with every movable electrical part in the starter, so that the electrical conditions remain always unaltered and require absolutely no attention. I make the resistance of the simplest possible construction, so simple in fact that it can be renewed at any part of the world if need be, without costing one farthing. The resistance I use is fresh water with soda or oxide of sodium. If fresh water and soda cannot be obtained for this purpose, sea water without the added soda may be used.

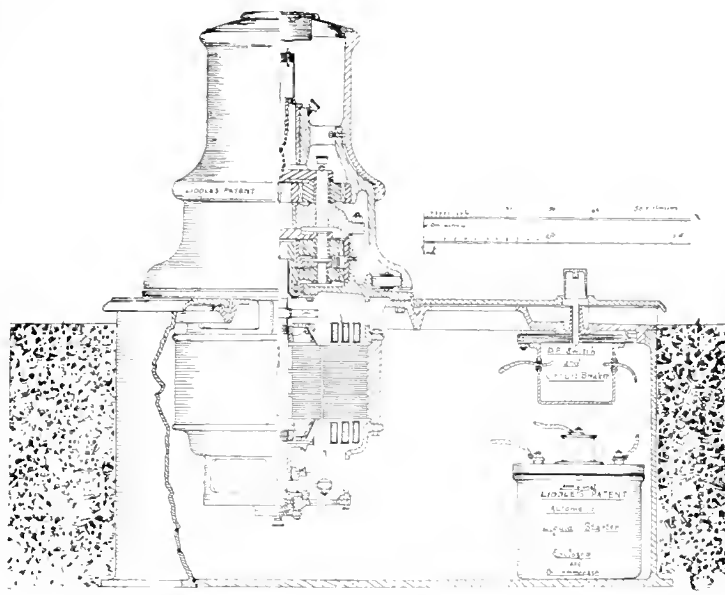
The only electrical point requiring consideration is the switch for starting or stopping the motors. The mechanical action of this switch should be such that its blades have no



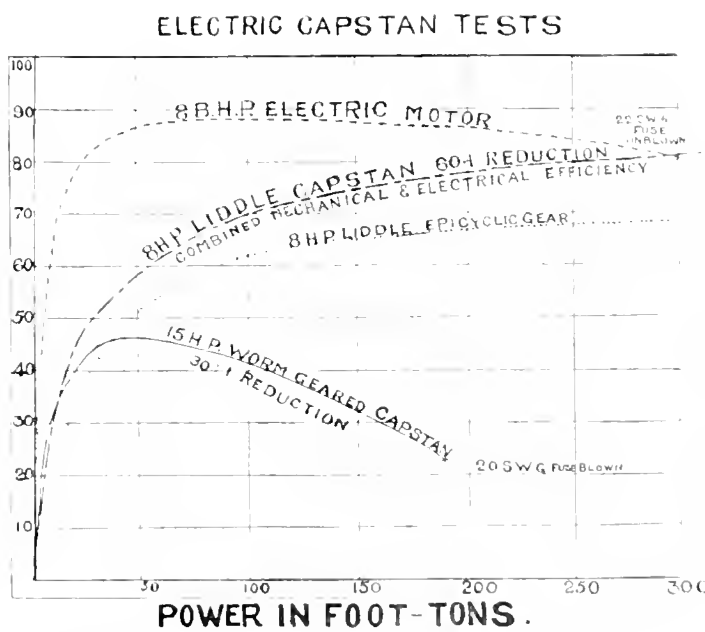
Marine Electric Capstan with motor below deck
When circumstances prevent the motor being below deck, a cast-iron motor tank is used, the sides of the tank being fitted with weatherproof manholes, for inspection

intermediate position between full on and full off, or full off and full on, or in other words it must be impossible for the operator to hold the switch in any mid-position. This switch can be arranged to work mechanically by means of lever, pedal, wheel, key or any other desired method. So far as the electric motor is concerned, everything is automatic and is quite independent of the person acting as operator.

Before leaving the high-speed electrical motor, there is a point worth drawing attention to, *viz.*, vertical spindle motors. With these, even though the ship has a considerable list the working conditions remain unchanged, and all out of balance forces such as gravity effects are eliminated. Within the past few years several prominent motor builders made use of ball bearings on motors. On horizontal motors these proved failures and the motor builders were obliged to go back to the old type of bearing. With vertical spindle motors ball bearings have proved a perfect success, and can be run for twelve months on one lubrication. In ship work there are numerous advantages to be gained by the use of vertical spindle motors. Time is too limited to allow of my going into this subject here, but from practical experience I could produce many points in favour of the vertical spindle motor which would recommend it to the attention of marine engineers.



Electric Capstan with Motor Well
Used for shipyard and dock work



The Royal Society of Arts, Edinburgh, appointed a Committee of Experts to enquire into the claims of this gear, and the following curves show the results of their examination when they tested an 8 H.P. Liddle Capstan to 22 H.P. The Capstan tested was not specially built

I must now come to the question of gearing or linking up of the high and constant speed motor to capstans, winches, and other ship auxiliaries. Belting is suitable for fairly high speeds, but is quite out of the question in ship work. I might consider worm or skew gearing. These gears have practically reached their zenith of perfection, but the improvements which have been made in worm gears have been reached more through practical experience and tests than through theoretical calculations. In fact, from theoretical calculation

it is impossible to design a worm and worm wheel with a bearing surface contact greater than the theoretical plane, and that only for one tooth. To me the worm and worm wheel have a resemblance to Cook and Peary. There is a certain amount of doubt as to the pole which was reached. With the worm and worm wheel there is always a certain amount of doubt as to the tooth surface in bearing contact.

The loss of energy due to friction between two solids varies directly as the pressure between the solids and is practically independent of the area in contact, but it must be remembered that if we exceed a certain pressure there is no such thing as a solid. After we pass the critical pressure the law of friction becomes of the fluid order. The loss of energy due to friction varies as the velocity squared. At slow speed fluid friction is very small.

The laws of Nature cannot be altered to suit our convenience. If we aim at success we must design to take the greatest advantage possible of these laws. Before we decide whether a worm and worm wheel are to be of use in connecting high-speed motors to capstans, winches, etc., the critical pressure, per square inch which the worm and worm wheel material will withstand must be found, and the greatest rubbing velocity permissible must be discovered. The rubbing velocity between the worm helix and the worm wheel is to a certain extent dependent upon the lubricant, but after a certain pressure has been reached no lubricant is of any use. Again, we know that if a worm and worm wheel cannot be driven backwards, the mechanical efficiency is less than 50 per cent. Further, if they can be driven backwards, the speed-reducing factor is small. From the aforegoing it will be seen that the useful purpose of a worm gear is generally with very light loads if the speed is fairly high. If the load is to be heavy, the speed must be very, very slow, and if the efficiency is to be above 50 per cent., the reducing factor must be small. From this it will be seen that I must either discard my high-speed motors or the worm gear.

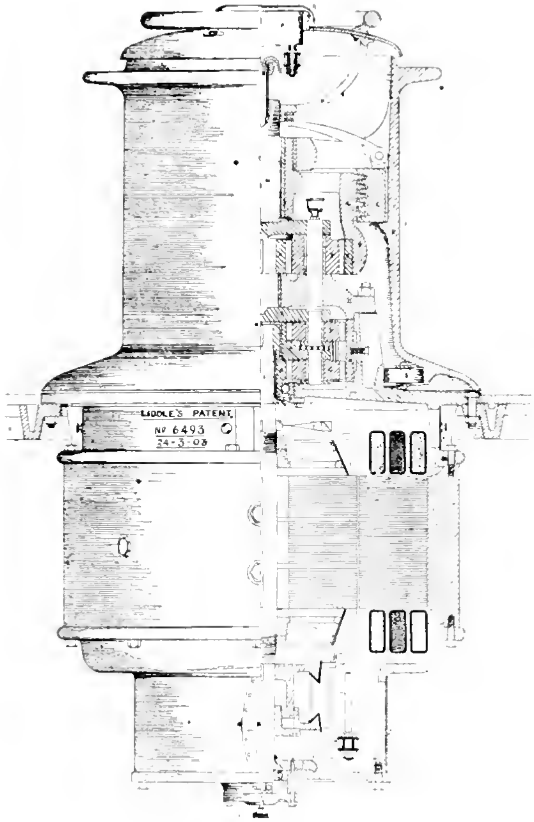
Considering ordinary gears we have several different styles and types to select from, *viz.*, rawhide, fibre, paper, bronze, cast iron, cast steel, forged steel, etc. Then there are the types of teeth, such as plain, helical, double helical, of involute, cycloidal, or other form. I do not think there is any place in which we could gain more information regarding wheel teeth than at a motor garage where old motor cars of every description are repaired. Within the past dozen years a new class of engineering has sprung up. It has doubtless many lessons to learn from the older system, but the older system has doubtless some lesson to learn from the new. I must say that I was completely beaten regarding successful gearing of the high-speed motor until I considered all types of motor car gears. Having now selected a forged-steel, machine-cut, case-hardened, short-toothed gear, I can settle the maximum speed of my electric motor. With ordinary teeth these gears may have a velocity of 6000 feet per minute. From this it will be seen that the continuous current motor speed is settled by the commutator, and the alternating current motor speed cannot be much in excess of that of the continuous. Therefore I select speeds of 1700 to 2000 up to 5 h.p., 1000 to 1500 from 5 to 20 h.p., etc. A 2000 rev. per minute motor could be fitted with a pinion one foot in diameter without exceeding the speed limit. On a motor of 2000 revs. per minute, however, I do not require a pinion of more than 3 or 4 inches in diameter, thus the tooth velocity is only one-third or one-quarter the permissible velocity. Further, these gears are at least twelve times stronger than similar gears in cast iron. In other words, a forged-steel pinion having machine-cut, case-hardened teeth 1 inch wide will do work which would break a cast-iron pinion 12 inches in width.

The next point is the arrangement of these gears in such a manner as to gain the greatest advantages. I again consulted motor car gear and gear box design, but failed to find exactly what I wanted. I found numerous examples, however, the worn parts of which showed me what to refrain from doing. In avoiding these defects of design I was led into a form of gear which has given very surprising results, results of which I had not the slightest thought when I designed the gear. Some of these are of vast importance in conjunction with any geared electric motor. Every electric motor when overloaded, or in other words when working under crane rated conditions, loses in efficiency on increase of load. If the motor is geared to the capstan, winch, etc., by means of gear which also falls in efficiency when the load is increased, the combined efficiency must necessarily be poor, and as the load increases the current consumption will increase out of all proportion with the increase of load, and as a rule the safety fuse will blow. In marine work for the fuse to blow might mean disaster. In the bulk of electrical machinery for deck use, the safety fuses must only be safeguards against electrical breakdown.

With high speeds, balance of motion is very important, otherwise serious vibrations would be set up. By balance of motion I mean all turning effort forces, mass, reaction, etc. If these forces are balanced, so that all forces in common balance are contained in plants and act at 90 degrees to the common axis of motion, with their common point of action lying in the common axis of motion, then every force is neutralizing every other force, and all the energy imparted by the motor spindle to the gear is imparted by the first set of gears to the second set, and thus on until it is used in doing external work such as warping, hoisting, etc. If these theoretical conditions existed, the gear efficiency would be 100 per cent., but such conditions are impossible. It is possible to very nearly balance all forces, but it is impossible to avoid a certain amount of friction. The friction with which I have to deal always falls under the law of friction between two solids, therefore the loss of energy due to friction is directly proportionate to the pressure between moving parts. As all forces are balanced, the only pressure between moving parts takes place at the planet studs, and the faces of wheel teeth. At these points the relative movement is very small, the contact surface is large in proportion to the pressure acting on it, therefore the loss of energy is small, and as the wear of parts is always proportionate to the frictional energy wasted, it follows that the wear of parts is small. From tests made on this gear it was found that the gear efficiency increased as the load was increased, thus the gear assists the motor on heavy loads, and the current consumption of a motor thus geared may be looked upon as directly proportionate to the load. One of the great advantages of this gear from a constructional point of view is that every part is acted upon by known forces, the majority of them being simple shearing forces, therefore it is an easy matter for the designer to calculate every tooth and pin, allowing an equal factor of safety throughout without any fear of unknown influences disturbing or affecting the structure.

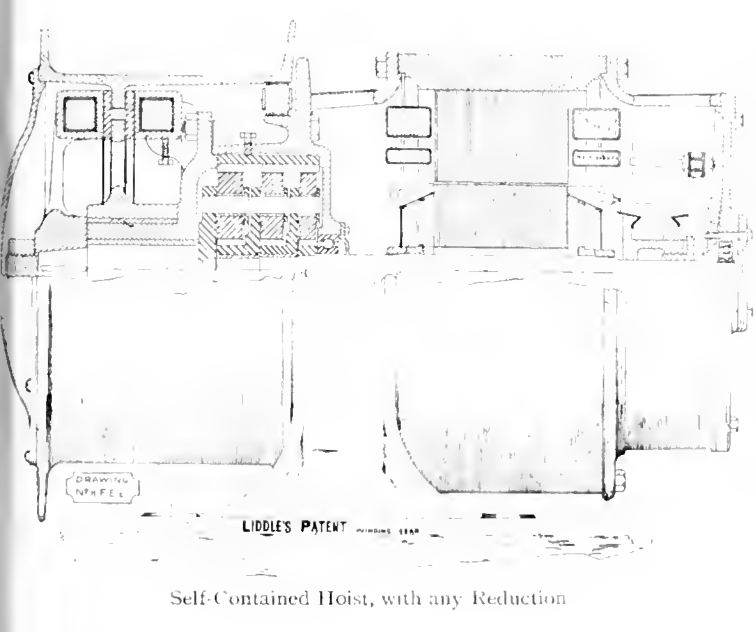
In arranging any warping, hauling, or hoisting mechanism comprising a motor, gear and winding apparatus, I always design it so that of itself it is a complete structure having the main casting in one piece, and such that it is always subjected to the lateral stress of the rope, thus the driving motor and the gear are only subjected to balanced turning effort. Then regarding the space occupied by this gear. A 50 to 1 reduction was fitted to a 5 h.p. motor. The overall dimensions of the gear case were $10\frac{1}{2}$ inches in diameter, by $3\frac{1}{2}$ wide. Pinions meshing into each other did not differ in diameters more than $2\frac{1}{2}$ to 1. To give a reduction of 350 to 1 at 5 h.p., the gear added to the motor would only require to be 5 inches instead of $3\frac{1}{2}$ as in the former case. Such gears when fitted to the vertical spindle motor and lubricated with thick black cylinder oil, and after being a short time in use, run perfectly silently and without the slightest vibration. These gears fitted to horizontal spindle motors run fairly silently, but not to equal the vertical spindle type. An electrical capstan, winch, or hoist as before described has weight and volume cut down to a minimum whilst the electrical-mechanical efficiency is the highest ever obtained. The current consumption for work done is the lowest possible. The life of such a capstan is difficult to determine, but from examination for wear on those working, I should certainly say it will exceed the life of the present-day steamship.

Were it not for the low efficiency, steam is an ideal prime mover for warping and hoisting machinery. Its compressive or cushioning properties are exactly what is wanted. For instance, a steam capstan when warping on ship board automatically slows down as the tension on the warp increases. When the tension exceeds a certain limit the capstan will stand with the steam pressure on. To be a success an electrical capstan must do likewise. If it cannot do so it is a failure. This is where electricity fails, because an electric motor keeps up a constant speed quite independent of the pull on the warp. The current increases with the pull,but the speed remains constant. To get over this difficulty an electrical con-



Electric Vertical Spindle Winch with Friction Clutch

The end of the rope is permanently fixed to the barrel. The load being gradually started by a clutch. To unwind the rope the barrel free-wheels.



Self-Contained Hoist, with any Reduction

trol is used. I have, however, already decided against any electrical control on the motor. I have before given certain reasons for doing so, but here I will give yet another. Electricity has practically the same velocity as light. There is a certain time element in its heating action to cause fusing, etc. I hold that the most alert men we have are not sufficiently alert to deal by hand with electrical energy supplied to an electrical capstan. One slip in the operator's actions blows the safety fuses, and the ship is left to the wind. I propose to make the warping action of the capstan almost entirely automatic. I propose attaching to the circumference of the internal toothed wheel a magnetic disc, or oil clutch which can be tuned to slip at a warping pressure below that necessary to blow the safety fuses. When such a capstan is warping it will warp at full speed until the warp is under full tension. Then it will automatically stop, and when the tension is slightly slackened it will recommence warping. It will continue in this way until the ship is warped to its destination. The fuses will not blow unless an electrical breakdown occurs.

An electrical apparatus has one very decided advantage over one driven by steam. Steam machinery can never exert more pull than there are lbs. pressure of steam on the pistons, whereas an electric motor can develop almost any power for a short interval. Owing to the possession of this property, an electrically driven windlass could entirely defeat a steam windlass if extracting a fouled anchor or at any similar process.

OBITUARY.

THE LATE MR. A. J. CRIGHTON.

IT is with great regret we note the announcement of the death of Mr. A. J. Crighton, of the firm of Béliard, Crighton & Co., Antwerp, on April 16th. Some two or three years ago Mr. Crighton was, along with others, examining the after-part of a steamer afloat in the Dock at Antwerp, when the punt tilted and he overbalanced himself and fell headlong into the water. The shock was severe, especially as to his heart which was strained, so that he suffered much and was from time to time under medical supervision, with periods of relief, until he succumbed.

He was well known as an engineer to a large circle on the Continent and elsewhere, and the ill news of his death has evoked many expressions of sorrow. He was educated at Dollar Academy in Clackmannanshire, served his apprenticeship with Messrs. D. Rowan & Son, and also served with Messrs. Hutson & Co., Glasgow. He then went to sea for about nine years and after holding a first-class certificate and sailing as chief engineer, he turned his attention to shore work and joined Messrs. Béliard & Co., as a partner in the well-known Antwerp firm. He was a member of the Institute of Marine Engineers.

We hope to reproduce in our next issue a photograph of the late Mr. Crighton, as it could not be obtained in time for this issue.

The late Mr. John Hay.—We regret to have to record the death on April 11th of a well-known engineer in the person of Mr. John Hay, assistant superintendent engineer for Messrs. F. C. Strick & Co., of London. Mr. Hay spent his early years in Glasgow, in which port he served his apprenticeship with the firm of Messrs. Jas. Howden & Co. After serving at sea for a period of about nine years, five and a half of which were as chief engineer, he was appointed to the position which he held at the time of his death.

THE Austro-Hungarian battleship *Zrinyi*, 14,500 tons, was recently launched at Trieste. The *Zrinyi* was from the yard of Stabilimento Tecnico. She is the third ship of the *Radetzky* class, and has a displacement of 14,500 tons, engines of 20,000 h.p., and a speed of over 20 knots. The armament includes four 13·8-in. guns, eight 9·5-in. guns, twenty 4-in., and eight 2·7-in. guns, besides two 3-in. machine guns and three torpedo quick firing guns.

REVIEWS.

Official Year Book of the Scientific and Learned Societies of Great Britain and Ireland. Price 7s. 6d. London: Charles Griffin & Co., Ltd.

This book is a record of the work done in science, literature and art during the session 1908-1909. The year book first made its appearance in 1884 and since that date twenty-five annual volumes have been issued, and the work has become established as a book of reference of the Societies. It gives all that has been done in fourteen departments of research and presents in a convenient form the conditions of membership, together with a list of the papers, with the authors' names, read before the Societies.

Rhodes' Directory of Passenger Steamers, 1910. Price 2s. 6d. nett. London: George Philip & Son, Ltd.

Rhodes' Directory of Passenger Steamers is now in its twenty-third year of publication, and is published at a popular price. The 1910 edition contains particulars of over 4000 passenger steamers and includes twenty full-page illustrations. In the present issue the number of entries has been almost doubled and many particulars are given about each boat. In addition to the alphabetically arranged list of passenger steamers, the steamship companies are given, with their fleets.

Engineers' Year Book, 1910. By H. R. Kempe, M.I.C.E. Price 8s. London: Crosby, Lockwood & Son.

The 1910 edition of this well-known work has made its appearance, containing upwards of 1200 pages and 1000 illustrations. The present edition has been rendered as up-to-date and complete as possible, many of the sections having been practically rewritten and the whole work subjected to close revision. Some well-known men have revised and extended several of the chapters, among whom we may mention Mr. W. H. Booth, C.E. (gas and oil engines). Mr. Brysson Cunningham, B.E., A.M.I.C.E. (harbour and dock engineering), and Mr. Percy A. Hillhouse, B.Sc., M.I.N.A. (naval architecture and marine engineering). An idea of the extent of the changes made since the first publication in 1894 is afforded by the fact that the total number of pages has increased from 506 to 1200.

Sell's Directory of Registered Telegraphic Addresses for 1910. Price 21s. London: 166, Fleet Street.

The first volume of this directory was issued twenty-five years ago and consisted of 100 pages. It has steadily grown, until now it has reached 2300 pages. In addition to 80,000 telegraphic addresses of the United Kingdom, it contains a list of trades, classified, and 30,000 colonial and foreign cable addresses. The firms grouped under the trade heading of engineers extend to many pages, the different classes of engineers being separated and almost every town in the United Kingdom represented. There are something like 3000 different trade headings, under which are grouped long lists of firms which make it an admirable book for obtaining estimates, etc., from the principal firms of a trade. Every name in the book has been given a particular number, which can be used for cabling full names and addresses to subscribers in one word, instead of three or four words, a system which is made much use of by large firms. Mr. Sell is to be congratulated upon the appearance of the new volume and its arrangement, scope and comprehensiveness.

The Directory of Shipowners, Shipbuilders and Marine Engineers, 1910. Subscription price, 5/-, after publication, 10/-. London: The Directory Publishing Co., Ltd.

This directory is in its eighth year of publication and its annual edition is now looked for with interest. The present edition has been thoroughly revised and brought up-to-date and about fifty pages have been added. The information given will be found very useful to shipowners, shipbuilders, marine engineers, dock owners, shipping agents and many others. As usual, the book opens with an index to names of shipowners, shipbuilders and marine engineers, followed by an index to names of same arranged alphabetically in order of towns. Under the shipowners' section is to be found a list of each company's fleet with some particulars of each boat. This is followed by a list of shipbuilders and marine engineers, including the British Royal naval dockyards, a list of consulting marine engineers and naval architects, an index to names of boats, and closes with a personal index to directors and other officials of shipowning, shipbuilding and marine engineering firms.

Rose's Universal Code Economiser. Price 10/6 nett. London: Sidgwick & Jackson, Ltd.

We have received a copy of the new and revised edition just published. It is claimed for the publication that it is the only system by which a transposition error of whatever magnitude can be detected at sight and rectified immediately by the recipient of the message. The work is not a new code-book, but is intended as an adjunct to all existing code-books. The fundamental basis of the system is that the number of the message in an ordinary code-book is used in place of the code word. This number is converted by a simple process and reference to a small key table into a new word which is transmitted.

War Ships: A Text Book on the Construction, Protection, Stability, Turning, etc., of War Vessels. By Edward L. Attwood, M.Inst.N.A. Price 10/6 nett. London: Longmans, Green & Co.

This excellent volume, well conceived and admirably executed, has now reached a fourth edition, and the new issue contains some extra matter and illustrations having reference to more recent practice in regard to warship construction and equipment. There are now over 200 diagrams in the book in addition to other illustrations, and the Admiralty Memorandum on the design of the *Dreadnought* has very properly been retained in the appendix. Mr. Attwood's work should be in the hands, not only of all naval officers and ship constructors, but of all laymen who take an interest in naval affairs, giving as it does in a concise and lucid manner a complete epitome of the material of the British Navy at the present time. A good index, and the blank pages at the end for notes as in previous editions add greatly to the value of the work.

BOOKS RECEIVED.

Engineering Workshop Machines and Processes. By Dipl.-Ing. F. Zur Nedden, translated and revised by John A. Davenport, M.Sc. (Vict.), etc., with an introduction by Sir Alex. B. W. Kennedy, LL.D., F.R.S., etc.

CATALOGUES.

Messrs. Lacy-Hulbert & Co., Ltd., have sent us a list of their very interesting "Boreas" rotary pumps for all kinds of liquids, which they are at present manufacturing.

Messrs. Balcke & Co., Ltd., have just issued a new catalogue of pneumatic tools and air compressors. It is stated that the tools and compressors are only now put on the market, and that some of their features are a distinct advantage over those at present in use.

Messrs. D. Ramsay, Smith & Co. send us a leaflet of their patent high-speed shallow draught tunnel for hydroplanes, motor boats and shallow-draught vessels. It is stated that a hydroplane punt or flat-bottomed motor boat fitted with a small petrol motor and the shallow-draught attachment will permit travelling on very small draught of water. Messrs. Ramsay, Smith & Co. will be pleased to advise anyone interested.

Battleship Engine Design.—At a meeting of the Glasgow Branch of the Association of Teachers in Technical Institutions, which was held in the Technical College, Glasgow, Mr. Alexander Norwell, B.Sc., C.E., occupying the chair, Mr. Alexander Galbraith, F.R.S.E., assistant superintendent engineer, Cunard Steamship Company, Liverpool, read a paper entitled "Some notes on the procedure in designing the engines of a battleship." The author showed how the plans for engines of the description mentioned are prepared, special attention being given to such points as the preliminary design and the over-all length. The method of determining the centre of gravity of the engines, the boilers and the auxiliary machinery was next touched upon, then followed an explanation of the most important calculations. Every point of outstanding importance, from the commencement of the design to its completion, was explained in detail by a series of lantern slides.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent).

Notable Launches.—Saturday, April 9th, formed a notable day in the annals of Clyde shipbuilding, on account of three vessels, each in some respects or other out of the ordinary, having been sent off the stocks. Of greatest note, and of more than usual interest as regards naval work, was the launch of the 20,500-ton battleship *Colossus* for the British Navy, which was sent off the stocks by Scott's Shipbuilding and Engineering Co., Greenock. Almost a record has been scored in connection with the construction to the launching stage of this mighty warship. Although the intimation of the Admiralty's intention to give Scott's Company the order for the battleship was received on 5th May last, the official contract was not given till two months later; and without this the work could not proceed. It was, therefore, not till July 10th that the first rivet was driven through the keel plate; so that the whole time occupied in the building of this—the largest battleship in the world—occupied less than nine months. For a vessel so enormous this is a splendid feat for a private firm, and ranks with anything accomplished by any of the Royal dockyards. At Dumbarton, by the same tide, Messrs. Wm. Denny & Bros. put into the water the torpedo-boat destroyer *Yarra*, the second built of the Australian Commonwealth fleet. The third vessel was the 1000-ton steam yacht *Doris*, sent off the stocks of Messrs. John Brown and Co., Ltd., Clydebank. This handsome and palatial pleasure craft has been built for Mr. S. B. Joel, the owner of the present steam yacht of the same name.

Rapid Construction.—Mercantile shipbuilding has its records as well as work accomplished by private shipbuilders for the Royal Navy. In this respect Messrs. Chas. Connell and Co., Whiteinch, are by way of finishing a remarkably fine performance if, indeed, it does not constitute a record. In September last they received an order from Messrs. Donaldson Bros. for a twin-screw passenger steamer of about 10,000 tons and with accommodation for about 1250 passengers. This vessel—the *Saturnia*—was launched last month, and it is now definitely stated that she will run her trials at the end of May and begin her maiden voyage to Canada on 11th June, within nine months of the placing of the order. Considering the extra amount of internal fittings on a passenger steamer compared with a cargo vessel, this is a highly creditable achievement. The machinery, which has been constructed by Messrs. Dunsmuir & Jackson, Govan, consists of two powerful sets of triple-expansion engines with steam supplied from six boilers.

New Ships Ordered.—Messrs. Barclay, Curle & Co., Ltd., Whiteinch, are building, in addition to two steamers for the British India Steam Navigation Co., placed early this year, two other vessels for the same Company more recently placed. The additional vessels are about the same size as the others—4200 tons gross—but they will have more passenger accommodation and they will have a speed of 16½ knots as compared with 14½ knots. All the four vessels are intended for the Eastern service and will trade between Calcutta and Chinese and intermediate ports.

Messrs. Charles Connell & Co., Scotstoun, have received an order from Messrs. Thomas Law & Co., Glasgow, for a high-class cargo steamer of the shelter-deck type, with large measurement capacity and of the following dimensions 404 ft. by 53 ft. by 28 ft. 3 in. She is to be built to Lloyd's highest class, and will carry 8400 tons deadweight. The engines will be supplied by Messrs. Dunsmuir & Jackson Glasgow.

Messrs. Alexander Stephen & Sons, Linthouse, have received an order from Messrs. Elders & Fyffes, Ltd. London, for the construction of a steamer for the banana and passenger trade. The vessel which is to be of about 4100 tons, is to be delivered next February. It will be similar in general design and dimensions to the *Tortuguero*, built by the Messrs. Stephen last year for the same owners. A similar order, it may be added, has been placed by the same owners in the hands of Messrs. Workman, Clark & Co., Belfast.

Messrs. Wm Denny & Bros, Dumbarton, have received from the New Zealand Shipping Co. London an order for a large twin-screw passenger and cargo steamer similar to the *Ruahine*, which has recently completed her first voyage and to the *Rotorua*, which is in course of construction in Messrs. Denny's shipyard. The dimensions of the new vessel will be—Length between perpendiculars 484 ft.; breadth, 62 ft.; depth, 35 ft. The engines, by Messrs. Denny & Co., will be of the reciprocating type, while those of the *Rotorua* are of the combined turbine and reciprocating order.

Messrs. Ferguson Brothers, Port Glasgow, have received an order from the London & North-Western Railway Co. for a large and powerful combined suction and grab dredger. The vessel, which will be employed at Garston Dock, near Liverpool, will be capable of lifting material at the rate of 1000 tons per hour. The firm are sending to the Anglo-Japanese Exhibition, to be opened shortly at the "White City," Shepherd's Bush, a splendid collection of models representing a selection of the notable work accomplished by them in the way of dredgers and tugs of all types.

Messrs. Napier & Miller, shipbuilders, Old Kilpatrick, who launched on April 14th a new paddle steamer for passenger service on the Clyde, named *Eagle III.*, which they have built for Messrs. The Buchannan Steamers, Ltd., Glasgow have received an order from Messrs. Lever Bros., Port Sunlight, for a steamer 265 ft. in length, the engines for which will be supplied by Messrs. J. G. Kincaid & Co., Greenock.

Messrs. William Hamilton & Co., shipbuilders, Port Glasgow, who are at present one of the busiest firms on the Clyde having on order seven vessels of large carrying capacity, all of which will be built on the Isherwood system, of which the Messrs. Hamilton are the sole lessees on the Clyde, have recently secured a contract to build another steamer of about 9000 tons carrying capacity. The vessel, which will be over 400 ft. in length, will be the largest vessel ever built by the firm. They have also recently received an order for the construction of a large floating dock for foreign owners. This dock, which will be capable of lifting vessels of ordinary dimensions, will be built in sections, and launched complete similar to those already built by the Messrs. Hamilton for Swedish and for Dutch owners. This additional contract for the floating dock, with the work already on hand, will keep Messrs. Hamilton's yard busy for at least ten months.

Messrs. Murdoch & Murray, shipbuilders, Port Glasgow, have received a contract to build a steamer for South American owners. This, the eighth steamer Messrs. Murdoch and Murray have on order, is for service on the river Amazon.

Messrs. A. Rodger & Co., Port Glasgow, have received orders to build three steamers, one being a large cargo-carrying steamer for Messrs. Hugh Hogarth & Son, Glasgow. The machinery for the vessel will be made at Messrs. Rodger and Co.'s engineering works, Helen Street, Govan.

Messrs. The Greenock & Grangemouth Dockyard Co. at their Greenock yard are laying the keel of a steamer recently ordered by Messrs. J. & J. Denholm, Greenock. She is to be 250 ft. in length and have a carrying capacity of 2200 tons on a draught of 17 ft. The machinery will be supplied by Messrs. Dunsmuir & Jackson, of Govan. At their Grangemouth yard the Company have three steamers of similar dimensions on hand for Messrs. James Currie and Co., Leith, for their general cargo trade and the last of the trio was set afloat on April 12th. The vessels which are 235 ft. in length, by 30 ft. beam by 18 ft. 4 in. deep, are designed to carry a large cargo on a light draught. A special feature is the large capacity for water ballast in double bottom peak tanks and deck tanks; the design also securing a very low nett tonnage. The engines are by Messrs. Richardsons, Westgarth & Co., Middlesbrough.

Messrs. The Ailsa Shipbuilding & Engineering Co., Troon and Ayr, are to build at their Ayr yard for Brazilian owners a twin-screw river steamer 122 ft. long over all. The vessel will have saloon and ladies' cabin and deck accommodation will be provided for a large number of passengers. The engines will be supplied by the builders.

The Ardrossan Shipbuilding Co., Ardrossan have received an order from Messrs. Paton & Henry, Glasgow, for three steamers, a cargo and passenger vessel for the colonies and two vessels for their own United Kingdom coasting trade. The machinery for the colonial vessel will be supplied by Messrs. D. Rowan & Co., Glasgow.

Messrs. Ramage & Ferguson, Leith, have received an order from the Ellerman Lines (Ltd.) to build and engine

a steamer of 1800 tons carrying capacity, to be employed in that Company's Portuguese trade.

Messrs. The Caledon Shipbuilding Co., Dundee, have booked an order for a steamer about 300 ft. in length for foreign owners.

Messrs. Dobbie, McInnes, Ltd., Glasgow, Newcastle and London.—Following on the recent death of Mr. John C. Dobbie, formerly chairman of Messrs. Dobbie, McInnes, Ltd., Mr. Walter P. Clyde, director of the engineering department, and Mr. W. W. Gebbie, director of the nautical department, have been appointed joint managing directors of the company.

Measured Mile Trials.—Additional testimony to the value attaching to results from speed trials over the measured mile at Skelmorlie on the Clyde, is afforded by the presence lately on this renowned stretch of water of the Belgian-built and owned cross-Channel steamer *Jan Breydel*. This is one of a couple of twin-screw turbine steamers built by the Société Anonyme John Cockerill of Hoboken, Antwerp, for the Belgian Government mail and passenger service between Ostend and Dover. The maximum speed obtained on the mile as the mean of four runs was 24·975 knots, while on four runs between the Cloch and Cumbrae lights, which affords even a better criterion of the vessel's capability in actual service, the speed attained was 24·389 knots. On a run over the mile stern first, the speed attained was 15·983 knots. In all cases the guarantee speed was exceeded and the results were considered most satisfactory by the Commissioners of the Belgian Government, and Commissioners appointed by the builders. This fine steamer left the Clyde for Antwerp on April 15th preparatory to taking up service between Ostend and Dover. Other vessels which have of late been put through the pace on the Skelmorlie mile are the torpedo-destroyer *Beagle*, built by Messrs. J. Brown & Co., the torpedo-destroyer *Grasshopper*, built by the Fairfield Shipbuilding and Engineering Co., for the British Government, and the *Santa Catharina*, one of the new Brazilian destroyers built by Messrs. Yarrow & Co., Scotstoun.

New Crane at Fairfield.—The Fairfield Shipbuilding and Engineering Co., Govan, are at present having erected alongside their fitting-out basin a mammoth cantilever crane of 150 tons capacity, similar in its general features to the crane at the fitting-out basin of Messrs. John Brown & Co., Ltd., Clydebank, and that at the basin of Messrs. Wm. Beardmore and Co., Dalmuir. Hitherto, at Fairfield, the heavy lifts in the fitting-out of naval and mercantile vessels have been overtaken by a set of powerful shear-lifts on the other side of the dock, and while these will still be utilized, the new crane will very materially enhance the fitting-out equipment of the dock, especially as concerned with naval ships, as it will be greatly superior in facility and speed of operation. An assurance has been asked from the Fairfield Company by the Clyde Navigation Trust that the erection of this large crane will not lead to the undue projection into the river of long vessels fitting out, and in reply the Company have written that their practice hitherto in dealing with vessels fitting out in the basin would not be altered in any way by the position and working of the new crane.

Clyde Trust Dock Equipment.—The Committee on Workshops of the Clyde Navigation Trust have recommended, and the Trust as a body have adopted, a proposal of the mechanical engineer—Mr. George H. Baxter—that the tender of Messrs. Siemans Bros., Ltd., to provide, at the total cost of £6442, an additional set for generating electric power required at Rothesay Dock, Clydebank, be accepted. The additional set will be steam-driven as in the case of the two existing sets. This decision was come to after a report had been considered on the question of making an arrangement with the Clyde Valley Electric Power Co. to supply current for the purpose. The report bore that the cost of generating the estimated total power required by means of the two steam-driven sets already installed, with the addition of a third similar set electrically driven, would be greater than with all three sets steam-driven.

TYNESIDE AND WEARSIDE.

(From our Own Correspondent.)

Tyneside.

The Tyne Commission.—The Tyne Improvement Commissioners have appointed a successor to the late Mr. James Walker, who was their Chief Engineer, in the person of Mr. N. G. Gedye, B.Sc., M.Inst.C.E., who has been Chief Assistant to Mr. W. T. Douglass, M.Inst.C.E., the well-known consultant of Victoria Street. He has had considerable experience in the design of harbour works, coast lighting, graving dock construction and submarine work in connection with pier and breakwater construction. He is thirty-five years of age and should prove a fitting successor to the talented former Chief Engineer.

The Newcastle and Gateshead Chamber of Commerce.—For some time a very strong local feeling has been aroused on the need of dock accommodation on the North-East Coast. This found expression in the advocacy on behalf of the Newcastle Chamber of Commerce, by Mr. G. Renwick before the Annual Meeting of the Association of Chambers of Commerce of the United Kingdom, of further dry-docking accommodation for warship repair. With the provision of a floating dock at the Thames, a "Dreadnought" would still be unable to find dock accommodation between the North of Scotland and the Thames, and therefore the claims of the Tyne as a naval repairing base in this sense should be considered. This was agreed to by the Association.

Messrs. W. G. Armstrong, Whitworth & Co., Ltd.—It is stated in the local press that Messrs. Armstrong, Whitworth & Co. have probably secured the order for the armaments of the Australian and New Zealand battleship-cruisers of the improved *Invincible* type, the armament consisting of eight 12-inch guns and a secondary armament of 4-inch guns. Expectation is also strong that this firm has secured at any rate a portion of the Turkish naval contract, the total value of which will reach about five million sterling. It is also rumoured that an order will shortly be given by the Chinese Government for a second-class cruiser. At the present time work is proceeding on the British battleship, the *Monarch*, whose keel was laid on the 1st April, while the cruiser *Weymouth* is getting into an advanced state and the cruiser *Newcastle* went down the Tyne from the Elswick yard to Messrs. R. Stephenson & Co.'s yard at Hebburn on the 18th April. This vessel has a displacement of 4,800 tons and was launched with her engines and boilers on board. The battleship for the Brazilian Government, the *Rio de Janeiro*, is well in hand at Elswick, while the scout *Bahia* has now left the Tyne on her way to South America. At the Walker shipyard of the same firm eight ships are under construction having a total tonnage of 29,500. A dividend of 10 per cent. on the ordinary shares of the Company has just been declared, together with 4 per cent. on the preference shares.

Messrs. Palmers' Shipbuilding and Iron Co., Ltd.—In addition to the work on the battleship *Hercules*, which is being pressed forward, this firm is also constructing a cargo boat of considerable capacity, while the Ellerman line has recently placed orders for two new cargo boats. Work upon these will be commenced shortly.

Messrs. John Readhead & Sons, Ltd.—This South Shields firm of shipbuilders has recently launched a new steamer, the *Elmmoor*, belonging to the Moor line, and at the launch Sir W. Runciman drew attention to the heavy shipping depression which had been experienced, quoting the dividends of some of the steamship companies, which ranged between nothing and three per cent. He was, however, sanguine as to the future. Messrs. Readhead are preparing to construct two more cargo boats, each of 7,200 tons capacity, for the same firm.

Messrs. Hepple & Co., Ltd.—Another South Shields firm are busy with an order for an icebreaker-tug for Vladivostock. The vessel is, after construction, to be shipped out in sections. The firm is also constructing a vessel for the Glen Steam Coasters, Ltd.

Messrs. R. Stephenson & Co., Ltd.—It is reported that the receiver and manager of this Company has suggested to the debenture holders that the shipyard department at Hebburn should be disposed of, as, owing to bad trade in shipbuilding at present, adequate financial support for this department would not be obtainable. It is, however, suggested that the engine works at Darlington shall be carried on.

The Wear.

The Wear Commission.—During the past month the annual meeting of the River Wear Commission has been held, and the report of work done during the past year is extremely

satisfactory, as the port was stated to be in a state of greater efficiency, both as regards the present trade and that which might be developed later, than at any other period in its history. In the immediate future it is proposed to deepen the channel still further, while the Bill introduced to Parliament for the raising of additional revenue will facilitate the development of further schemes for developing the port.

Messrs. W. Doxford & Sons, Ltd.—Another important event of the past month has been the annual meeting of Messrs. W. Doxford & Sons, Ltd., when a trading loss of £21,319 on the year was declared. To meet this, together with an amount for depreciation, debenture interest and preference dividend, £42,500 was drawn from the reserve funds. There has been a slight increase of output during the year from five steamers of 20,271 tons to eight steamers of 28,160 tons, and prospects are a little brighter. Two steamers of 8,000 tons capacity each, to the order of the Prince line, of Newcastle, are now under erection by the Company, while orders are in hand for two large steamers for the Norwegian ore trade. Two similar vessels to the Prince steamers mentioned above are also to be built by Messrs. Short, of Sunderland. It is also reported that Messrs. Doxford have received an order for two cargo steamers, one of 5,700 tons, and the other of 6,400 tons, from the Eskside Steam Shipping Co., of Whitby.

Messrs. J. L. Thompson & Sons, Ltd.—An interesting development in the case of the missing liner, the *Waratah*, is that the *Wakefield*, built last year by Messrs. J. L. Thompson and Sons, Ltd., has been sent out from Durban to search for any traces of the vessel. The vessel has been specially furnished with a powerful search-light equipment and other apparatus suitable for conducting the search.

Messrs. Sir James Laing & Sons, Ltd.—Information has now been made public that creditors of the Laing's shipyard to the extent of £50 and upwards are receiving £1 shares in the reconstructed company to the amount of 50 per cent of their claims, any odd figures in the poundage being settled by payment of 7/6 in the pound. Among the creditors accepting payment in this way is the Sunderland Corporation by virtue of its large electric power account, and it is trusted that the proposed settlement may pave the way to a long-continued period of useful work.

A Rumoured Large Order.—The "Glasgow Herald" has recently published an interesting communication from its London correspondent to the effect that seven vessels, five of which are 7,500 tons capacity and two of about 10,000 tons carrying capacity, have been ordered from North-East Coast shipbuilders, whose identity is not disclosed, for the purpose of carrying Wabana ore to Philadelphia and the Continent. It is further stated that one, if not more, further vessels are still to be ordered for this Canadian service.

THE TEES AND HARTLEPOOLS.

(*From our Own Correspondent.*)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, are now very busy with work on hand. Nothing new is reported during the month, but they expect shortly to book an order for an iron ore steamer reported to be for Canadian owners.

Messrs. W. Harkess & Son are reported to have secured an order for a small coasting steamer, and are busy with work on hand.

Messrs. Smith's Dry Dock Co. are reported to have orders to build two trawlers and are very busy on contracts in hand.

Messrs. Bolkow, Vaughan & Co. have placed a large contract with Messrs. Mirrlees, Watson & Co., Glasgow, for a condensing plant installation complete to deal with about 380,000 lbs. of steam.

Messrs. Richardsons, Westgarth & Co., Ltd., report nothing new, but are busy with work on hand and expect shortly to secure two enquiries that are in the market.

Stockton and Thornaby.

Messrs. Robert Ropner & Sons are reported to have secured the contract to build a medium-sized cargo boat, to be engined by Messrs. Blair, and are fairly busy with work on hand.

Messrs. Craig, Taylor & Co. have secured the contract to build a cargo steamer of about 8,000 tons deadweight of the single-deck type to the order of Messrs. The Clapham S.S. Co., Ltd. (Messrs. Henry Clapham & Co.), Newcastle-on-Tyne, for early delivery, and with the work on hand are fairly busy, but prices remain very low.

Messrs. Richardson, Duck & Co. are busy with work on hand, most of which is on the Isherwood system, of which they have now made quite a speciality.

Messrs. Blair & Co. are reported to have secured the contract to supply the machinery for two cargo steamers building locally, but are not yet up to their full output, but are as busy as the state of trade fairly warrants.

West Hartlepool.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Harbour Yard, have secured the contract to build a small cargo boat for Messrs. G. W. Turnbull & Co., Leith, who have just recently sold the s.s. *Lamorna*, launched during the month to their order. They have been busy with repair work and have all their berths occupied.

Messrs. W. Gray & Co. have booked a contract for two cargo steamers of about 9,200 tons deadweight to the order of Messrs. S. M. Kiehnle-Christensen & Son, Bergen, for delivery next January. They are full up of work at their new yard and are also fairly busy at the old yard where smaller vessels are built.

The Central Marine Engine Works are very busy; they have to supply the machinery for the new boats to be built by Messrs. W. Gray & Co., and are reported to be as busy as they have been at any time in the history of the firm.

Hartlepool.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Middleton, are now busy with two boats for Messrs. Furness, Withy and Co. Although the ballot has gone against the co-partnery scheme, it is thought it will be amended and tried again for another year.

Messrs. Richardsons, Westgarth & Co., Ltd., have secured the contract to supply the machinery for the steamer to be built for Messrs. G. W. Turnbull & Co., Leith. They have also secured the contract to supply a condensing plant for Stepney, to have about 3,000 ft. cooling surface. They are also very busy in their speciality department.

The s.s. *Lamorna* has been renamed the *Graanhandel* and sold to Messrs. Scheepvaart Maatschappij, Gylsen—also the s.s. *Appomatex*, of 3,338 tons, built in 1893 for about £6,500—the s.s. *London City* to Yorkshire coal owners as a coal hulk for about £5,000 and the s.s. *Urania* to foreign owners for £3,500, all owned at this port.

THE HUMBER AND DISTRICT.

(*From our Own Correspondent.*)

Hull and the Soya Bean Trade.—The beans are shipped from Vladivostock, also Dalny, and form a growing trade at Hull. They are shipped in bags to the docks, discharged into barges, and transhipped to the sides of the mills, upon the (commonly known as the) Old Harbour, which abounds with oil mills. The beans are taken from the barges by elevators, then crushed in heavy American rollers, put into kettles, heated by steam and the oil extracted; there is about 18 per cent. of oil, and the millers extract 12 per cent. of oil, thus leaving 6 per cent. The pulp is put into hydraulic presses, coming out in the shape of cakes for feeding purposes for cattle and horses. This is one of Hull's great industries, and is the means of employing thousands of men. Watsons, of Matchless Soap fame, are building now, at Selby, the largest oil mill in the world; the cost of the building and machinery will be very great. In the docks, the s.s. *Largo Law*, *Masunda* and *Volone* are now discharging Soya beans. On passage to Hull is the s.s. *Dunlap*, *Knights Errants*, *Knight of the Thistle*, *Lothiar*, *Ulka Rickmers* and many others carrying beans.

Messrs. Earle's Shipbuilding and Engineering Co., Ltd., are very busy with new and repair work docking etc. Recently they launched the new Wilson liner *Eskimo*, a fast steamer for Norwegian trade, passenger and mails, and the s.s. *Deasbury* for the Great Central Railway Co. This is the first steamer of a contract for four, and is intended for the Grimsby and Continental trades, passenger and cargo. I understand the firm has some inquiries for new steamers.

Messrs. C. D. Holmes & Co., Ltd., have been successful in securing several sets of boilers and machinery for Grimsby and Hull owners. Their branch shop at Alexandra Dock deals largely with general docking and repair work.

Messrs. Amos & Smith are kept fairly busy with repair work, likewise their branch at Alexandra Dock. They have secured contracts to build the machinery and boilers of ships building in the north and Humber for local owners.

Messrs. Cooper & Co., Ltd., have secured the contract to repair and put into commission again the s.s. *Berlin*, after being ashore in the Humber; she is owned by the L. & Y. Railway Co. The cost of repairs will run into a big sum. Their two dry docks have been kept up to high pressure lately with repair work, and they have also had to secure the Hull and Barnsley Dry Docks for docking several large steamers. The branch shop at Alexandra Dock has been well employed with repair work, and the moulding shop at Neptune Street is kept busy with propellers for home and foreign orders.

Cochrane & Sons, Selby, whose yard is situated on the river Ouse, have several drifters on hand, building, and they have booked several trawlers to build for Hull and Grimsby owners.

Hull Central Dry Dock & Engineering Works, Ltd., seem to be in the front with docking and repair work. They have had to engage the Hull and Barnsley Dry Docks, not being able to complete the work in their own dry dock. The following repairs have been executed: s.s. *Wreathier*, bottom repairs, boilers and machinery, deck repairs and put through Lloyd's Survey; s.s. *Derwent* (L. & Y. Ry.), shell repairs and a large number of new plates; s.s. *Queen Alexandra*, s.s. *Zamora*, s.s. *Labuan*, s.s. *Paul Paix*, s.s. *Nyanza*, s.s. *Fimriete*, usual deck and engine repairs; s.s. *Camma* now in the firm's own dry dock having stem fitted, bow plates, and other general deck and engine repairs.

W. H. Warren, New Holland, has had several new orders, and is at present building a new steel motor lighter d.w. 65 tons; one store lighter for Devonport; and two lighters for Hull. A large steel lighter of 185 tons is ready for launching.

Goole Shipbuilding & Repairing Co., Ltd.—This old-established firm is keeping to the front again. They are in a good position to build and repair fairly large steamers, and have been successful in securing the building of four steam trawlers for Hull owners, and two for Fleetwood owners, all to be built to Lloyd's highest class. An order to build a steamer for the Wilson Line, of Hull, for their Hull and Newcastle trade, to carry about 730 tons, has also been secured. This steamer will be built at the Dundee yard, and I trust these orders will be the forerunners of many more.

Messrs. Cook, Welton & Gemmell, Beverley, have secured the building of several trawlers for Grimsby and Hull.

The North-East Coast Engineering Works.—This new firm is steadily gaining ground. They have had the following steamers during the month undergoing repairs and dry-docking: s.s. *Harry Wadsworth*, s.s. *Gascony*, s.s. *Hotham Newton*, s.s. *Leonidas*, s.t. *Powerful*. The firm are well equipped for propeller work and all kinds of repairs.

Messrs. Stewart & Craig, engineers and boilermakers, have been busy during the month on the following steamers s.s. *Fancy*, repaired ballast tank and other general repairs; s.s. *Ceres*, engine and deck repairs; and general repairs on several of Finland Line steamers. Small repairs on several other steamers have been done.

Messrs Woodall & Co., engineers and boilermakers, have had several repairs on coasting steamers, including deck and engine-room, and many repairs to the boilers and machinery of the Hull Corporation Tramways department.

The Humber Iron Works keep fairly busy with the patent slips. They have slipped several English and foreign steamers for cleaning and painting. A number of hands are employed in the engine works and in the smith's shop and boiler shop departments. They have several foreign enquiries for heavy repair and dock work.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent).

The Royal Mail Steam Packet Co.'s steamer *Trent* arrived at this port on the 18th of last month after the completion of extensive repairs at Messrs. Harland & Wolffs'. It will be remembered that the *Trent* went ashore at Cartagena in January, 1909, and after being about eight weeks on the reef was successfully refloated and brought to Southampton under her own steam. She will take up her position on the Company's West Indian mail service on the 11th of this month. The Company's inter-colonial steamer *Esk* is due to arrive about the beginning of this month, having been displaced by the new inter-colonial steamer *Balantia*, which has recently been completed by Messrs. Harland & Wolff.

The Union Castle Co.—The latest addition to this Company's fleet, the *Edinburgh Castle*, is due at Southampton early this month, and will sail on her maiden voyage to South Africa on the 21st inst.

The London and South-Western Railway Co.'s new cross-Channel turbine steamers are to be named the *Cæsarea* and *Sarina*, by way of compliment to Jersey and Guernsey, if the Board of Trade's sanction is given.

Messrs. Simpson, Strickland & Co., Ltd., Dartmouth.—This firm have booked several orders and work is more plentiful than it was a short time ago. Orders in hand include a 45-ft. galvanized steel launch for service abroad. She will be fitted with four crank engines, with an oil-fired water-tube boiler, and the speed is to be 18 miles per hour. The launch will be similar to the *Satanelle*, recently built by them for service on Lake Windermere. An order has been received from the Brazilian Government for a 34-ft. steam cutter, a 34-ft. sailing cutter and two 30-ft. sailing cutters, and an order has been received from the Admiralty for a 50-ft. steam pinnace. A 33-ft. steam pinnace is in hand for the Italian Navy, and last month the firm delivered a 36-ft. motor pinnace for the Russian Navy. A smart piece of work was recently performed for Mr. C. L. H. Loeffler, owner of the s.y. *Albion*, a 20-ft. clincher-built mahogany launch with compound engine and oil-fired boiler being delivered in fourteen days. The boat was out running trials ten days after the order was placed. A very interesting little boat for the B.M.B.C. Restricted Class is completing for Mr. E. Atkinion Smith to the design of Mr. James A. Smith, and will be raced under the name of *Etukishook*. Two very handsome steam launches are on order for Messrs. G. L. Watson & Co., for the s.y. *Doris*, recently launched at Clydebank to their design for Mr. S. B. Joel. Several boilers and complete sets of machinery are on order, in addition to overhaul and fitting-out work.

Messrs. Day, Summers & Co., Ltd., Northam Ironworks, are carrying out extensive machinery repairs to H.M. telegraph ship *Alert*. The London and South-Western Railway Co.'s steamer *Laura*, which was damaged by collision with the Swedish barque *Sophie*, is also in their hands for repair, and also the Guernsey Steam Towing Co.'s *Alert*. The new twin-screw tug *Neptune*, which the firm have just built and engined for the South of England and Isle of Wight Co., completed her official trials last month, the horse power developed being 1600, which is a very satisfactory result. Particulars of this tug were given in our April issue. Considerable alterations are in hand in connection with the machinery of the s.y. *Lady Evelyn*. The s.y. *Sabrina* completed her refit and sailed last month. The new passenger and cargo steamer, which the firm are building for South America, is in frame and good progress is being made with the machinery. The firm have in hand their 80th set of sheer legs, which are designed for a lift of 100 tons at an overhang of 56 ft. from the perpendicular. They are intended for Aberdeen. The front legs are 130 ft. long and the back leg 170 ft. long. These new sheer legs are a repeat order, the firm having supplied a smaller set in April, 1874, these latter having been tested with a weight of 80 tons. The old sheers are still in constant use and have now had thirty-six years' continual service. The new sheer legs are necessary owing to the large increase in size of steamers using the port.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works.—H.M.S. *Savage*. This vessel has had a preliminary dock steam trial and it is expected that she will complete her official trials early this month. H.M. Ships *Larne*, *Lyra*, *Martin* and *Minstrel*. The shell plating of the two former vessels is completed and work is progressing rapidly on the *Martin* and *Minstrel*. An order has just been booked for a powerful motor fire-float for the service of the Metropolitan Fire Brigade, and an early start will be made with this work.

Repair Work.—The Repairs Department continues to be

well occupied and the vessels now in hand are H.M. Ships *Halcyon, Research* and *Volcano*; Steam Yachts *Christine* and *Margarita*; s.s. *Alchymist*, "L. 26A.," and the *Rohilla*.

The London & South-Western Railway Co. have definitely decided to increase the width of the Trafalgar Dry Dock in order that the mammoth liners now building for the White Star Co. by Messrs. Harland & Wolff may be conveniently accommodated. At present this dock is one of the largest dry docks in the world, the depth of water over the sill being 33 ft. 6 in. H.W.O.S.T. There is, however, another and more important question to be settled, *viz.*, the dredging of the channel to a depth of 35 feet in order that these new vessels may not be delayed in their regular sailings owing to insufficient depth of water. The channel has recently been dredged, at considerable expense, to a depth of 32 feet, but the White Star Co. have already intimated to the authorities that this is insufficient and that the vessels will draw at least 35 feet, hence the question arises, who is to foot the bill for the additional dredging? The parties chiefly concerned are the Corporation, The Harbour Board, and The London & South-Western Railway who own the docks. Various suggestions have been put forward to find a satisfactory solution for all parties concerned, and by the time these notes are in print the Special Committee of the Harbour Board will have doubtless made some definite recommendations on the subject. One suggestion put forward was that as the Board were asked to deepen the Channel for these vessels the White Star Co. should contribute to the cost by making a certain yearly payment to the Board extending over a period of years. Another suggestion which has been discussed is the raising of the harbour dues. The present rate is 1d. per ton, but the Harbour Board have the power to charge 2d. per ton on all shipping entering the port. This proposal would seriously affect the shipping community and would probably result in a direct loss of business, the present depth being quite sufficient for the requirements of the vessels now using the port. That a satisfactory solution to this momentous question may be shortly forthcoming is a "consummation devoutly to be wished."

Considerable interest has been aroused in local shipping circles owing to the peculiar situation arising out of the recent visit of the Argentine Government's vessel *Chaco*, which after discharging a cargo of grain here proceeded to Penarth to coal. The officers of the vessel claimed exemption from light dues, their contention being that as she was a Government vessel she was entitled to such exemption. The Argentine Consul at Cardiff maintains this view, and states that the grain was only taken on board to "stiffen" the ship. On the other hand, shipowners take the view that if ballast be required it should be water, not corn.

THAMES.

(From our Own Correspondent.)

The New "Dreadnought."—The vessel of this class to be built on this river had her keel plate laid with some amount of ceremony on April 13th. The Chairman of the Thames Ironworks Co., Mr. Arnold Hills, was happily able to be present after attending the Company's annual meeting. The slip on which the *Thunderer* is to be built has been lengthened, and is the one on which the *Black Prince* was erected some years ago. Large derricks have been constructed 100 feet high on each side of the slip, and a great deal of work has already been assembled, and it only remains to put this in position to show some progress almost from the start. A particular German crane has been obtained for assisting in executing this order, and this has occasioned a question in the House of Commons as affecting the secrecy of the design of the vessel, but the crane will be erected by the shipbuilders themselves under the supervision of one German foreman, so there can scarcely be any danger, and more especially as the crane is erected on a pontoon in the river 100 feet away from the ship.

Port of London Enquiry.—The enquiry conducted by Lord St. Aldwyn on behalf of the Board of Trade has now terminated. On the question of coast rates being one half those charged on oversea traffic it was decided that, in view of the difficulty of proving that the traffic was oversea and not coastwise, the powers of the Port of London Authority were not extended. As to the security of goods for the non-payment of dues by the owner, shipowners desired a lien on the goods and on the opposite side it was contended the remedy should be in the ordinary way. The shipowners, however, got their way on the question.

The P. & O. Co. and New Zealand.—Beginning with the departure of the *Malwa* from London on December 31st last, an experimental programme of three direct monthly sailings by this Company in connection with their service to Australia has been tried. The results are said to have proved satisfactory and it is announced that the Company intend next autumn to extend the voyages of certain of their new class of boats to Auckland, thus providing a direct service *via* the Suez Canal during both the outward and homeward seasons.

Thames Steamboats.—On the 30th April the new City Steamboat Co. undertook to inaugurate a ten-minute service from Battersea Park to Greenwich. The scale of fares put forward is 6d. the whole way and 3d. from London Bridge in either direction. At this reasonable figure there is no doubt in the summer season a fair business may be done by holiday makers, providing the weather holds good.

Trinity House.—The Lord Mayor entertained a distinguished company at the Mansion House to lunch to meet the Prince of Wales and the Elder Brethren. About 400 were invited, and among those present were Lord Charles Beresford, Mr. Asquith, Mr. Balfour, Mr. Reginald McKenna, First Lord of the Admiralty, Sir Hudson Kearley, Chairman of the Port of London Authority, and Sir Philip Watts, Director of Naval Construction. The gathering was evidently a notable one.

The South Pole Expedition.—The preparations on the *Terra Nova* lying in the West India Dock are now practically complete, and the expedition will leave a month earlier than intended, *viz.*, in the first week of June. The crew are all selected and the saloon accommodation for the twenty-four officers and scientists has been improved by the erection of a substantial deck-house, while laboratories have been fitted up on the port side for the scientific work and various other alterations effected.

Royal Merchant Seamen's Orphanage.—The annual meeting of this institution has been held at the Baltic under the presidency of Mr. J. L. Devitt, and in the report of the Board of Management it was stated that sixty-four children had been admitted during the year and fifty-six had left, and thanks were given to shipowners and commanders for the collections sent in, the balance sheet being satisfactory.

The Nautical Almanac Office.—The Superintendent, Dr. A. W. Downing, who has held the position since 1892, severed his connection with the public service recently. The importance of this work to the shipping community is well known, it being aptly described as the Sailor's Bible. The labour involved in its production appears prodigious, as a new issue comes out annually and the volume is not a small one.

Woolwich Tunnel.—This undertaking will be commenced immediately and is estimated to cost £78,500. It is intended for foot passengers only, and to obviate the drawback of fogs in the winter, which prevent the ferries keeping up a service. Entrance and exit will be by stairways.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

Messrs. Cammell, Laird & Co., Ltd.—At the recent annual meeting Col. Wm. Sidebottom stated that the financial position of the Company had improved to the extent of £200,000. At the Coventry Ordnance Works, in which Messrs. Cammell Laird & Co. are interested, an order has been secured for the mountings of all the heavy guns for one of His Majesty's ships, thus utilizing the heavy machinery recently installed. The *Renard*, the first of the three destroyers of the 1908-9 programme of the "Beagle" class building by this firm, underwent her first preliminary trial when it is understood the contract speed was obtained, this constituting rather a remarkable performance considering the stringent requirements imposed. The vessel will proceed shortly to the Clyde, and is expected to go into commission in the early autumn. The [illegible] and [illegible] of the

same class, are rapidly nearing completion. The two Wallasey Ferry-boats are framed and plating is nearly completed, and it is expected to launch them next month. These vessels will embody all the features of the *Isis* and *Daffodil* with improvements, and are being built to Lloyd's and Board of Trade highest requirements and to the specification of Messrs. Hannay & Given, of London and Liverpool, whilst Captain Marsh and Mr. Rennie are superintending the work for the Wallasey Urban Council. The Isle of Man Steamer *Snaefell* has now shipped all her machinery and is nearing completion and will shortly proceed on her trial, previous to taking her place in the Company's service. This vessel, while being both fast and lavishly fitted up, will also be capable of maintaining the Company's requirements for winter passenger and cargo service. The four destroyers for the Argentine Government are making rapid progress, the keels being now laid and frames bent, and when finished will somewhat resemble the British Tubal class, but with special features to suit the requirements of Southern waters, combined with high speed and large radius of action.

The slips at the Tranmere yard are well filled just now. The London & South-Western Boats will shortly be put into the water; the fine lines of these boats give them an appearance of speed. The three repeat boats for the Nelson Line are well in frame. The huge basin required for the building of the floating dock is completed and work is being commenced at once upon this huge structure. The pontoon for use as a floating crane for foreign owners is now about completed. It will shortly be dismantled for shipment. Ten lighters for the Booth Steamship Co. are now in hand for rapid delivery, two of which are now launched and being outfitted.

Repair work naturally bulks largely in a port like Liverpool, and this firm have had their share of this work. *La Marguerite* is being rapidly finished and is expected to be ready shortly. The Midland Railway Co.'s *Duchess of Devonshire* is having a thorough overhaul, including new boilers. The Isle of Man Steam Packet Co.'s steamers *King Orry* and *Mona's Queen* have been in for overhaul, and the same Company's boats, *Princess of Wales* and *Queen Victoria*, are to be docked shortly. The full-rigged ship *Robert Duncan* has recently been sold to new owners in San Francisco, and after taking on stores will leave dock. The sailing ships *Dinomene* and *Austrasia*, which have been lying up, have been sold to the Niger Co. and German owners respectively.

Messrs. H. & C. Grayson.—As is well known, this firm have facilities for rapid repair work at the North and South districts of Liverpool, also at Garston and Birkenhead. Amongst varied classes of repair work recently executed may be mentioned the Russian steamer *Count Muravjef*, having been fitted to carry cold produce from China, the *Stanton* recently stranded, the *Derbyshire* of the Bibby Line, the *Doonas*, *Dorset* and *Cheviot Range* have been in for annual overhaul and repairs. At Birkenhead the steamers *Delaware* and *Triton* are in hand, the latter owned by Trinity House.

Messrs Clover, Clayton & Co.—This firm have been increasingly busy at their extensive Birkenhead yard. The training brig *Jas. J. Bibby* has been docked and repaired previous to putting to sea. The steamers *Monksgarth*, *Birker*, *Force* and *Rose Lea* have had various repairs, while at the West Float graving dock the French ship *Hoche* is having extensive overhaul. Large repairs to the dredger *Cornwall* have been completed, also repairs to lightships *Meteor*, *Comet*, and the steamers *Marzo* and *Jane Rowlands*.

The David Wilson Patent Noiseless Winch Co.—Many orders have recently been placed for these improved winches, ships recently fitted including the *Prince Rupert* and *Prince George* for the Grand Trunk Pacific Railway Co.; they are also being fitted to the new Nelson Line steamers. Amongst other advantages claimed are absence of noise and increased efficiency.

Messrs. David Rollo & Co.—This firm have had large overhauling repairs to the bottom of the G.W.Ry. Co.'s steamer *St. Andrew*, also work on the same Company's steamer *Great Southern*; also they have received orders for new boilers for the Donald Currie's steamer *Rutland*.

Death of a Liverpool Shipbuilder.—By the recent death of Mr. John Evans, Liverpool has lost the father of its shipbuilding industry. Mr. Evans formed with his brother the firm of R. & S. Evans & Co. some seventy years ago, the head of which firm is now Mr. S. S. Evans, son of deceased. Until the site of the old yard was required for dock extensions, many of the best-known wooden and iron ships were built by this firm, which now confine themselves chiefly to repair work.

The Wallasey Ferry Co.—With the addition of two new steamers in the near future, and with the record of having carried over 20,000,000 passengers without serious accident in the year, this Company may well claim to be the finest Ferry Company in the world.

The Liverpool Engineering Society.—At a meeting of this Society on April 6th, at the Royal Institution, a most interesting paper was submitted by Mr. John M'Govern, a local authority on naval architecture. The title was "The Structural Arrangements and Strengths of Certain Types of Ships." A discussion followed.

The Cunard Steamship Co.—The annual report recently issued states that while there will be no dividend £80,000 has been placed to the reserve and £6,988 carried forward. The steamers *Aleppo*, *Cherbourg*, *Saragossa*, *Etruria* and *Umbria* have been sold. The *Etruria* is in the hands of Messrs. Ward & Co., while the *Umbria* has been sold to the Forth Ship Breaking Co. for £20,000. This vessel was the last word in naval architecture twenty-six years ago, and her demise will not be without regrets. The new steamer of 18,000 tons gross building on the Tyne, will be named the *Franconia*, and will be employed in the Boston trade and to Mediterranean Ports. By the calling of this Company's steamers at Fishguard, a saving of 3¼ hours in the delivery of the London Mail is obtained.

Isle of Man Steam Packet Co.—S.s. *Viking*, 10,000 H.P., previous to taking up her sailings at Easter, had the upper deck forward lengthened and thwartship casing added to form extra passenger shelter. This Company is one of the oldest, being formed eighty years ago.

The Liverpool Engineering and Condenser Co.—This firm continue to share the general prosperity of the port and have large contracts on hand, both naval and mercantile. They are supplying the distilling and evaporating machinery for H.M.S. *Blonde*. They are also supplying feed heaters, feed filters, etc., to the Isle of Man Company's new steamer, the London & South-Western Railway Co., and feed heaters, filters, and their patent duplex condensers to the Nelson Line. Upon the recent trial of the *Highland Laddie* a very high vacuum was maintained throughout the trial with this condenser.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Vickers' Prospects.—From what is actually confirmed and from rumours that are afloat, Vickers' seem to be in for a very brisk period. The amount of work in hand now, either in the drawing offices or the shops, represents millions of pounds, and there is quite a considerable amount of work not started upon yet. From every point of view these great naval construction works seem to be in for a busier period than ever in their previous history. The orders, which have not yet been placed by the British Admiralty, but will be in the course of a few months, will represent no small figure, for there are five battleships to be built, and apart from one being ordered from here, Vickers' are sure to share in the supply of armour and mountings for the others. The motto of Barrow is "Always Rising." It seems to apply to Vickers' works and the town also.

H.M.S. "Princess Royal."—This huge battleship-cruiser is as yet not started upon. The keel has not been laid yet, but one can expect this 26,300-ton leviathan to grow rapidly once the keel plates are riveted. The organization in connection with the building of this vessel is being perfected, and it will not be long before every department is working like some perfectly-made gearing. Each department will work up to stated dates and times, and from start to finish the vessel will be constructed from a time table as it were. The large turbines are beginning to assemble in the rough, and soon the machine shops will be busy with the thousands of different parts which go to indicate some 70,000 I.H.P. The twin set for the Devonport built *Lion* is taking priority,

the next job being the *Princess Royal's*. It is not known whether there will be a function in connection with the keel laying as in other yards, but, as far as Barrow is concerned, it will be of a private nature whatever takes place. There have been made certain extensions for the laying of the keel blocks, for this vessel is the longest ever built at Barrow—700 feet.

H.M.S. "Liverpool."—This cruiser is being got ready very smartly now, and by the middle of this month (May) she will be away for trials. She is similar to the other cruisers building on the Clyde and Tyne, but there are great expectations from the *Liverpool* as regards speed, and some very tall figures are whispered. Certainly if length and design are anything to go by there will be some startling results from the trials.

The "Sao Paulo."—The Brazilian battleship is beginning to look more finished. The guns are aboard and in a week or so into May she will leave to undergo her trials. In connection with the dry-docking of this vessel Vickers' are placed in a difficulty. They applied to Liverpool for the same docks as the *Vanguard* was overhauled in, but the Mersey Board were unable to oblige them and offered in place of it the one on the Birkenhead side. This, of course, means that the vessel would have to proceed a considerable distance up the river, and there are always risks connected with such journeys. This deadlock emphasises the absolute need of a dry dock being built at Barrow to accommodate any vessel afloat or likely to be. Vickers' works have become practically the largest in the world, and it is only natural that there should be a large dry dock attached. There was some talk of the Government subsidising Vickers' in regard to this development, but nothing has transpired as yet.

Brazilian Floating Dock.—The large floating dock which Vickers' are building to accommodate the Brazilian "Dreadnoughts" at Rio Janeiro is approaching completion. There was a momentary difficulty to overcome in regard to the introduction of a new oven for heating rivets. The riveters struck work, arguing that the new arrangement was not good for the boys who heated the rivets, but the trouble was soon got over and there was practically no delay in the work, certainly none that would affect the date of launching and dispatching. It is not known how the floating dock will be taken out to Rio Janeiro, and there have been rumours that Vickers' contemplated building a tug of their own to take it out. There is no confirmation of this rumour, but it is interesting to remember that when Vickers' were faced with the difficulty of conveying two submarine boats to Japan they solved the difficulty by building a steamer which was submerged in a dry dock and the submarines were floated in. That steamer has since returned to this country—with general cargo—did several voyages for both Vickers' and the Admiralty, was then altered and sold to an Italian firm.

The Midland Steamers.—During the past month or so the Midland Railway Steamers, four in number, have been to Barrow for overhauling prior to starting on the season's traffic with the Isle of Man and Belfast. The Isle of Man Steam Packet steamers have also commenced to leave, and it will not be long before the large vessels, *Ben-My-Chree*, *Empress Queen*, *Prince of Wales* and *Queen Victoria* are smartened up and put on their several stations. Six of the fleet—the largest—have wintered at Barrow.

BELFAST.

(*From our Own Correspondent.*)

BELFAST shipbuilders are well provided with work, and there is an increasing demand for labour, especially as regards the "black squad." Several important orders have recently been booked, and others are in course of settlement.

Messrs. Harland & Wolff.—The fitting-out of the magnificent Union-Castle liner *Edinburgh Castle* is nearing completion; the vessel will be ready for sea within a week or two of writing. The Royal Mail Steam Packet Company's *Trent* has left the port after having received extensive repairs and alterations, both in the machinery and hull department. The bottom damage was considerable, and all the work has been carried out in an expeditious manner.

The Leviathans.—The action of the Southampton port authorities in demanding from the White Star Line a sum of £2,000 per annum for ten years towards providing a sufficient depth of water for the accommodation of the *Olympic* and *Titanic* is in striking contrast to that of the Belfast Harbour Commissioners. The Belfast authorities are dredging the channel entirely at their own cost, to such a depth as will allow these vessels to leave the port. The *Olympic* and *Titanic* will rarely, if ever, be back at Belfast, so that no further revenue is to be looked for from them; on the other hand they would provide a very considerable and constant addition to the receipts of the southern port. Messrs. Ismay, Imrie & Co. are evidently determined not to accede to the demand.

Messrs. Workman, Clark & Co.'s yards are fully occupied, and further contracts of importance have been fixed within the past few weeks. A large steamer on the stocks in the north yard will shortly be ready for launching; another in the south yard will also in the course of a week or two be ready to take the water.

Lord Pirrie and Canada.—According to a recent Reuter's cable from Ottawa, incorporation has been granted to the Dominion Dry Dock Shipbuilding Co. The Corporation is being formed by Lord Pirrie, Sir Thomas Shaughnessy, Sir Robert Perks, Mr. Hugh Allan, and Mr. W. Dobell. It is stated that plants will be laid down at Quebec and St. John, New Brunswick, under the provisions of the new graving dock subsidy, the Government guaranteeing 3½ per cent. for thirty years on an outlay of four million dollars.

Messrs. Maccoll & Co.—A small steamer for Vancouver, B.C., for which this firm is providing the machinery, was launched by the Dublin Dockyard Co. on 9th April. The vessel, which is named *Cheslak*, will be towed to Belfast to receive her machinery, and after completion will sail for Vancouver.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Saskatoon.—On February 25th, there was launched from the yard of the Sunderland Shipbuilding Co., Ltd., a steel screw steamer 250 ft. length between perpendiculars by 42 ft. 6 in. broad, by 18 ft. 6 in. deep, having deck houses aft over machinery and topgallant forecastle, with Texas house on top. The vessel is of the single-deck type and will take the highest class in British Corporation for the Great Lake service. The deck machinery consists of steam winches, steam-steering gear and direct steam capstan windlass. A complete installation of electric light is fitted. The main engines are by the North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 17 in., 28 in. and 46 in. by 33 in. stroke, steam being supplied by two large boilers working at a pressure of 185 lbs. per square inch. The vessel has been built to the order of Messrs. J. W. Norcross and Co., Ltd., Toronto, Canada, and is thoroughly up-to-date in every way.

Itauba.—On March 9th, there was launched at Troon a steel twin-screw passenger steamer, built to the order of Messrs. John M. Campbell & Sons, Glasgow, for the Cia Nacional de Navegacao Costiara, Brazil. Her dimensions are 270 ft. by 42 ft. by 18 ft. 6 in. moulded, with a gross tonnage of 1550. Accommodation is provided for sixty first-class, and a limited number of third-class passengers. She is expected to attain a speed of 13½ knots. As the steamer left the ways she was named *Itauba*. Messrs. Wailes Dove & Co.'s "Bitumastic" cement was applied to the flat of bottom all fore and aft, and then "Bitumastic" enamel to the vertical structures in cellular double bottom, bunkers, peaks, ballast tanks, etc.

Eastern Prince.—On March 10th there was launched at Southwick a steel screw steamer, which has been built to the order of the Prince Line, Ltd., Newcastle-on-Tyne. The principal dimensions of the vessel are:—Length, 353 ft.; breadth, 46 ft. 3 in.; depth moulded to shelter deck, 31 ft. 8½ in. She is constructed to Lloyd's highest class under special survey with complete shelter deck. There are six water-tight bulkheads. The gear for loading and discharging cargo is of a very heavy and complete description, consisting

of two masts of extra strength and diameter, with four derricks to each, carried on heavy outriggers. In addition there is an extra heavy steel derrick, suitable for special lifts up to 50 tons. She has triple-expansion engines, the cylinders being 25 in., 42 in., and 60 in. by 45 in. stroke, steam being supplied by two large boilers of 180 lbs. pressure. The vessel is expected to attain an average speed of 11 knots an hour. The vessel was named *Eastern Prince*.

Tripoli.—On March 10th, there was launched on the Tyne a large steel screw steamer, which has been built to the order of Mr. Edward C. Thin, of Liverpool. The vessel is of the following dimensions:—Length overall, 306 ft.; breadth, extreme, 51 ft.; depth, moulded, 28 ft. 1 in. She will be capable of carrying about 7700 tons deadweight on a moderate draught of water. The vessel is of the shelter-deck type, fitted with four masts, and has been built under Lloyd's new rules for their 100 A1 three-deck classification. Immediately after the launch the *Tripoli* was taken to the works of the North-Eastern Marine Engineering Co., at Wallsend, where she will be fitted with triple-expansion machinery, having cylinders 26 in., 43 in. and 72 in. in diameter by 48 in. stroke, steam being supplied by two boilers 16 ft. 9 in. diameter by 12 ft. long, working at a pressure of 180 lbs., and capable of propelling the vessel, when laden, at a speed of 11 knots per hour.

Tavolara.—On March 10th, there was launched at Pointhouse a steel screw steamer for the Italian State Railways mail and passenger service. The vessel is 154 ft. in length, 26 ft. 6 in. in breadth, and 13 ft. 9 in. in depth. The vessel will be fitted with triple-expansion engines, and two large boilers. The machinery is designed to give a speed on service of 12 knots. The vessel, which is intended for service on the Sardinian coast, was named *Tavolara*.

Euston.—On March 10th, there was launched at Sunderland, the screw steamer *Euston*, for Messrs. Evan Thomas, Radcliffe & Co., of Cardiff. She is of 4750 deadweight capacity, of single-deck type, with poop, bridge and forecastle. The vessel has been built considerably in excess of the requirements of Lloyd's Register 100 A1 class, Home Office and Board of Trade regulations. This is the forty-second steamer built for Messrs. Evan Thomas, Radcliffe and Co. It is interesting to note that immediately after the launch of the *Euston* the builders commenced the laying down of another steamer for the same owners.

Prince George.—On March 10th, at the Wallsend Shipyard of Messrs. Swan, Hunter & Wigham Richardson, Ltd., the twin-screw passenger steamship *Prince George* was successfully launched for the Grand Trunk Pacific Railway Co. of Canada. The *Prince George* is a duplicate of the *Prince Rupert* which was launched at the Wallsend Shipyard last December, and which is now nearly finished and ready to be tried at sea. These two vessels will inaugurate an important service along some 750 miles of the beautiful coast of British Columbia, threading their way among innumerable islands between Prince Rupert and Vancouver Island and thence to Tacoma or Seattle. The *Prince George* has been very carefully designed and planned by Messrs. Swan, Hunter & Wigham Richardson, Ltd., for the requirements of the service. The builders have been aided by Mr. Richard L. Newman, of Victoria, B.C., the owners' naval architect and inspector, and by Captain C. H. Nicholson, their manager of steamships. The vessel will have two pole masts and three funnels, and with her straight stem and rounded cruiser stern, has a smart appearance. She is built to the highest class of the British Corporation for the intended service, and will comply with the Board of Trade regulations for passenger steamers. The twin-screw engines and also the boilers have been built by the Wallsend Slipway and Engineering Co., Ltd. The engines are triple expansion with four cylinders and cranks balanced on the Yarrow, Schlick & Tweedy system to ensure smooth running without vibration. The service speed of the ship is to be about 18 knots an hour. The chief dimensions of the *Prince George* are 320 ft. overall in length, 42 ft. 2 in. broad with a depth of 18 ft. to the main deck. On the shelter and main decks are long houses giving spacious and comfortable accommodation for about 220 first-class passengers, and some 1500 excursionists can also be taken on board. There will be refrigerated chambers for preserving dairy produce and other food, and the ship will be fitted throughout by electricity and heated by steam radiators, and also provided with an installation of wireless telegraphy.

Quantock.—On March 10th, Messrs. Wm. Doxford and Sons, Ltd., launched from their berths at Pallion, Sunderland, a large single-deck vessel, built to the order of the Tatem Steam Navigation Co., Ltd. (Messrs. W. J. Tatem and Co., mangers), Cardiff, for whom they have already built several steamers. The vessel is 365 ft. long, 50 ft. broad and of $28\frac{3}{4}$ ft. moulded depth, carrying 7400 tons deadweight on $23\frac{1}{2}$ ft. The classification is with the British Corporation Registry. The engines and boilers are also supplied by Messrs. Doxford.

Pentwyn.—On March 11th, the steamer *Pentwyn* was launched at Sunderland for the Pentwyn Steamship Co., Ltd. (F. H. Lambret, Barnett & Co., managers), Cardiff. The *Pentwyn* is a fine steamer of 6120 tons deadweight capacity, with a mean draught of only 21 ft. 4 in.; is classed 100 A1 at Lloyd's, and her main dimensions are as follows:—370 ft. overall, $50\frac{1}{2}$ ft. breadth, 24 ft. 3 in. moulded depth.

Scotch Lassie.—On March 14th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw drifter, the principal dimensions being 80 ft. by 18 ft. by 9 ft. moulded. The vessel has been built for Scotch owners to the order of Messrs. Crabtree & Co., Ltd., of Great Yarmouth, and will be fitted with compound surface-condensing engines by them, and is replete with all the latest improvements for this class of vessel.

Lamorna.—On March 14th, there was launched from the Harbour Dockyard of Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, the steel screw steamer *Lamorna*, built to the order of Messrs. Furness, Withy and Co., Ltd., West Hartlepool, for Messrs. G. V. Turnbull & Co., Leith, and the twelfth steamer built under Sir C. Furness's co-partnery scheme. The dimensions are 289 ft. 6 in. by 40 ft. 2 in. by 20 ft. $6\frac{1}{2}$ in. The vessel has a single deck, poop, bridge and topgallant forecastle and has been built to British Corporation Registry's highest class. A double bottom is fitted throughout on the cellular principle and the after peak is arranged as a trimming tank. She is constructed with bulb angle frames and longitudinal stringers, giving clear holds for the stowage of bulky cargoes. Four water-tight bulkheads divide the vessel into five water-tight compartments. There are four large cargo hatches, with a steam winch to each; the bulwarks have been specially strengthened for the carriage of deck cargoes, and the vessel is replete with all the latest improvements for loading and discharging expeditiously. A powerful quick-warping steam windlass is fitted forward for working the cables and steam-steering gear is fitted amidships, with hand screw gear aft and a large multitubular donkey boiler is also fitted. The cabins are heated with steam and the sanitary-ventilating, and lighting arrangements are effected on the most improved lines. Triple-expansion engines will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders $20\frac{1}{2}$ in., 33 in., 54 in. by 36 in. stroke, with two large single-ended boilers working at a pressure of 180 lbs. per square inch.

Lord Leitrim.—On March 15th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw drifter, the principal dimensions being 80 ft. by 18 ft. by 9 ft. moulded. The vessel has been built to the order of Messrs. The Lowestoft Steam Herring Drifters Co., Ltd., Lowestoft, and will be fitted with compound surface-condensing engines by Messrs. Crabtree and Co., Ltd., Great Yarmouth, and is replete with all the latest improvements for this class of vessel.

British Standard.—On March 15th, the *British Standard* was launched from the yard of Messrs. Wm. Pickersgill and Sons, Ltd., of Southwick, Sunderland, built to the order of Messrs. Brown, Son & Co., of Cardiff. The principal dimensions of this vessel are:—Length, 345 ft. 6 in.; breadth, 49 ft. 9 in.; depth, 25 ft. She has been built under Lloyd's special survey for their highest class, as a single decker, with deep bulb-angle frames and cellular bottom throughout for water ballast. Five extra large hatches are arranged with winches and derricks for lifting heavy weights, and a permanent steel fore and aft bulkhead has been fitted between hatches. The vessel will be rigged as a fore and aft schooner, with steel lowermasts and wood topmasts. The machinery,

which is to be supplied by Messrs. Geo. Clark, Ltd., of Southwick, is of the triple-expansion type, having cylinders 23½ in., 39½ in., 66 in. with a stroke of 45 in., steam for which will be supplied from two large steel boilers, with a working pressure of 180 lbs. A large donkey boiler is fitted in casing for use in working deck machinery.

Onitsha.—On March 15th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., launched from their Middleton Shipyard, Hartlepool, the steel screw steamer *Onitsha*, the seventh vessel built by that firm for Messrs. Elder, Dempster and Co., Liverpool, and the second of three passenger and cargo boats at present under construction at the Middleton shipyard, this being the thirteenth steamer built under Sir C. Furness's co-partnery scheme. The *Onitsha* is a beautifully modelled vessel having very fine lines, and is specially designed with main, upper and shelter decks. The vessel is otherwise strengthened to suit the Owners' West African trade. Her dimensions are:—Length, 375 ft.; breadth extreme, 50 ft., and depth moulded, 25 ft. 3 in. to upper deck, having all the 'tween decks and houses 8 ft. in height. She is classed Lloyd's 100 A1, and has cellular double bottom all fore and aft, with fore and after peaks for water ballast. The vessel is divided into seven water-tight compartments by means of six transverse bulkheads, and every attention has been paid to all appliances for the rapid loading and discharging of cargo. Nine powerful steam winches of the builders' own design, and ten derricks, capable of lifting five tons each, having been fitted. Provision is made on each mast for a special derrick to deal with 50-ton loads, whilst the whole of the mast arrangement is strengthened to lift 40 tons. The vessel has steel decks sheathed with wood on the poop, bridge and forecastle and promenade decks, and the whole of the passenger accommodation and public rooms are bright and cheerful, and under the second-class accommodation aft provision is made for large icehouses, mail rooms, specie rooms, paint rooms, lamp rooms and general store rooms. The vessel is fitted with the usual complement of lifeboats, together with six surf boats of special design for carrying palm oil through the surf. A complete installation of electric light will be fitted by Messrs. Campbell & Isherwood, including signal lamps, binnacle lamps, cargo clusters at each hatch, as well as oil lamps for emergency purposes. Steam-steering gear is placed amidships and a quick-warping steam windlass forward, steam being supplied to all deck auxiliaries from either of the three main boilers. The engines are of the triple-expansion type by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, having cylinders 25 in., 40 in., 68 in. by 48 in. stroke, with three main boilers working at a pressure of 180 lbs., and capable of driving the vessel at a fair rate of speed when loaded. A "Contraflo" condenser will be fitted, by which a vacuum of 27 in. can be carried in sea water up to 85 degrees, so that the engines will always develop the horse power intended and give the best result in speed and consumption. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the boiler-room tank and bilges, and their "Bitumastic" covering to the tank top in boiler-room.

Algeriana.—On March 15th, the Northumberland Shipbuilding Co., Ltd., launched from their yard at Howdon-on-Tyne, a finely moulded steamer built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, to augment their fleet of fine steamers. The vessel is 365 ft. long by 51 ft. 4½ in. beam by 28 ft. 4½ in. deep, and has been built under special survey to the highest class at Lloyd's. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation which is very ample being placed in steel house on the bridge deck. This steamer has been specially designed with a view to rapid loading and discharging of homogeneous cargoes, the hatchways being very long and wide, and are arranged for grain carrying in bulk, a complete set of shifting boards being fitted throughout to latest Board of Trade requirements. Ample deck gear is provided, consisting of eight steam winches by Messrs. John Lynn and Co., Ltd., Sunderland, and a large number of cargo derricks to ensure the expeditious handling of cargoes. She is fitted with the usual water ballast arrangements for light passages. The machinery will be supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 40 in., 67 in. by 45 in. stroke, three large steel boilers with 180 lbs. pressure. This vessel will carry about 7200 tons on a light draught and steam about 10 knots loaded at sea.

Largo.—On March 23rd, there was launched from the shipbuilding and repairing establishment of Messrs. S. P. Austin & Son, Ltd., the steel screw steamer *Largo* of 2700 tons deadweight capacity, which has been built to the order of Messrs. R. S. Gardiner & Joseph Reay, of the Pelton Steamship Co., Ltd., Newcastle and London, and is the fourth vessel constructed for the same owners. She will be classed 100 A1 in Lloyd's Register, under special survey, and ample water ballast capacity is provided so that the vessel may be able to make passages in all kinds of weather. The steam windlass has been supplied by Messrs. Emerson, Walker and Thompson Bros., Ltd., steam winches by Messrs. Clarke, Chapman & Co., Ltd., and the steam-steering gear by Messrs. Donkin & Co., these will be driven by a large Blake multitubular donkey boiler, and the vessel is in every respect specially adapted for quick loading and discharging to meet the owner's requirements for the coal trade, in which she will be engaged. The machinery will be supplied by Messrs. George Clark, Ltd., of Southwick Engine Works, of large power.

Llandudno.—On March 23rd, there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, a steel screw steamer built to the order of Messrs. Evan, Thomas, Radcliffe & Co., of Cardiff, and of the following dimensions:—Length, 303 ft.; breadth, 50 ft.; depth, 27 ft., and to class 100 A1 at Lloyd's on the single deck rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including seven double-cylindered steam winches, direct-acting steam windlass, steam-steering gear by Messrs. John Lynn & Co., Ltd., and Hastie's screw gear aft. The engines, which are to be supplied by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, are of the triple-expansion type having cylinders 25 in., 42 in. and 68 in. by 45 in. stroke, and working at a pressure of 180 lbs.

Blacktoft.—On March 23rd, Messrs. Wood, Skinner and Co., Ltd., launched from their shipbuilding yard at Bill Quay-on-Tyne a new steel screw steamer built to the order of Messrs. The Wetherall Steamship Co., Ltd., of Goole. The vessel is of the single deck type, with poop, bridge and topgallant forecastle. Water ballast is provided in the cellular double bottom and fore and after-peak tanks, and the vessel will be fitted with all the latest improvements and appliances for the rapid loading and discharging of cargo. The machinery has been constructed and will be fitted by Messrs. George Clark, Ltd., of the Southwick Engine Works, Sunderland. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering was applied to the tank top under boilers.

Elmmoor.—On March 23rd, there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields, a steel screw steamer, built to the order of Messrs. Walter Runciman & Co., Newcastle-on-Tyne. The vessel is of the improved single-deck type and is built to Lloyd's highest class and under their special survey; she is 358 ft. 6 in. in length by 50 ft. by 2[illegible] ft. [illegible] in., with poop, long extended bridge, and topgallant forecastle. The vessel is fitted throughout with wood shifting boards and feeders, in compliance with the requirements of the Grain Loading Act, and is well equipped with a large number of steam winches and derricks for the rapid handling of cargoes. She has a double bottom for water ballast as well as a large after peak tank. The vessel will be fitted with triple expansion engines, also constructed by Messrs. John Readhead & Sons, Ltd., having cylinders 25 in., [illegible] in., [illegible] in. by 45 in. stroke, steam being obtained from two large steel boilers of 160 lbs. working pressure. There is also a large marine type donkey boiler.

Hopeful.—On March 24th, Messrs. W. Harkess & Son, Ltd., launched from their yard at Middlesbrough a steel screw steamer 105 ft. by 30 ft. by 13 ft. [illegible] in. moulded, which has been built to the order of Messrs. F. H. Powell and Co., of Liverpool. She is designed with large cubical capacity to carry [illegible] tons on very light draught. She has extra large self trimming hatchways and clear holds, and is fitted with heavy deck machinery of the most modern type for the quick handling of cargoes. Her engines, which will be fitted by Messrs. Richardsons, Westgarth & Co., Ltd., of

Middlesbrough, are capable of driving her a speed of 10½ knots loaded.

Baltistan.—On March 26th, Messrs. William Gray & Co., Ltd., launched the large steel screw steamer *Baltistan*, which they have built for Messrs. Frank C. Strick & Co., Ltd., of Swansea and London. Her principal dimensions are:—Length overall, 362 ft.; breadth, 46 ft. 6 in.; and depth, 24 ft. 0 in. She is a handsomely modelled vessel of the two-deck type, with poop, bridge and forecastle and a sun deck over the bridge. An electric lighting installation is being fitted, including a Suez Canal projector light. The vessel will take Lloyd's highest class and has a cellular double bottom and after-peak tank for water ballast. The decks are of steel and teak. The steam windlass, steam-steering gear, steam winches, large marine type donkey boiler, and the whole of the outfit are of the most approved description, including Porter's patent derrick sockets for dealing with heavy lifts by combining the ship's ordinary derricks. The machinery is made by The Central Marine Engine Works of the builders, being of the triple-expansion type with cylinders 25 in., 40 in. and 65 in. and a 42-in. piston stroke; she is also fitted with Weir's feed pump and heater and two large steel multitubnlar boilers, working by Howden's forced draught at a pressure of 180 lbs. per square inch.

Cantilever Steamer.—On March 26th, Messrs. Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw cargo steamer built on the well-known patent cantilever frame system with topside water ballast tanks, to the order of Messrs. Elder, Dempster and Co., of Liverpool. The vessel is of the shelter-deck type and will have a deadweight carrying capacity of about 8100 tons, on a light draught of water.

Torbay II.—On March 28th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw drifter, the principal dimensions being 83 ft. by 18 ft. by 9 ft. 6 in. moulded. The vessel has been built to the order of Mr. W. T. Tripp, of Lowestoft, and will be fitted with powerful compound surface-condensing engines by Messrs. Crabtree & Co., Ltd., Great Yarmouth, and is replete with all the latest improvements for this class of vessel.

Malmanger.—On April 7th, there was launched from the yard of the Sunderland Shipbuilding Co., Ltd., a steel screw steamer, length between perpendiculars 235 ft., breadth extreme 37 ft. 6 in., and 17 ft. 8 in. deep, having raised quarter deck, bridge and topgallant forecastle, built to Norske Veritas highest class, under special survey; the vessel will carry 2300 tons deadweight on a light draught of water, and is fitted with water ballast in cellular bottom and peak. Five steam winches, steam-steering gear, large Cochran donkey boiler and direct steam windless are fitted. The engines are by the North-Eastern Marine Engineering Co., Ltd., and have cylinders 18 in., 30 in. and 49 in. by 33 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch. The vessel has been built to the order of H. Westfal Larsen, Esq., of Bergen, and during construction has been inspected by Mr. F. Th. Hansen and Captain Sunde, of Bergen. A Cochran (Annan) donkey boiler with patent seamless furnace has been fitted.

Djerissa.—On April 8th, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Djerissa*, which they have built to the order of Messrs. Frank C. Strick and Co., Ltd., of London and Swansea, for La Tunisienne Steam Navigation Co., of Paris. She will take the highest class in Lloyd's and is of the following dimensions, *viz.*:—Length overall, 362 ft.; breadth, 50 ft.; and depth, 25 ft. 11½ in., with long bridge, poop and topgallant forecastle. The hull is built with deep bulb-angle frames, cellular double bottom and large aft-peak ballast tank, ten steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead, and all requirements for a first-class cargo steamer, including Porter's patent derrick sockets for dealing with heavy lifts by combining the ship's ordinary derricks. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in. and 64 in. dia., with a piston stroke of 42 in., and two large steel boilers adapted for a pressure of 180 lbs. per square inch worked under Howden's system of forced draught.

Eskimo.—On April 9th, Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull, launched from their yard a handsomely modelled twin-screw steamer built to the order of Messrs. Thos. Wilson, Sons & Co., Ltd., for their passenger service between Hull and Christiania. The principal dimensions are:—Length, 330 ft.; breadth moulded, 45 ft.; depth, 27 ft. 6 in. The vessel has been constructed of steel to the British Corporation Registry's highest class and to Board of Trade requirements. She is of the three-deck type; on the upper deck there is a topgallant forecastle, a long bridge and a range of deck houses at the after end. Over the long bridge there is a range of deck houses, shelters and general promenade spaces for first and second-class passengers, known as the lower promenade deck; stairs from this deck lead up to the grand promenade deck, which extends for over 100 ft. The state-rooms for first and second-class passengers are situated on the upper and main decks amidships. There is ample accommodation for about 150 first, 50 second and 500 third-class passengers. Third-class passengers are carried at both the forward and after ends of the vessel on main and lower decks, and are berthed in commodious four and six-berth cabins; there are also three large and airy dining and recreation rooms for the use of passengers. The arrangement and fittings of kitchens, pantries and cold storage are thoroughly up-to-date and include all the latest improvements for this class of vessel. A complete installation of steam heating, electric lighting, bells, telephones and fan ventilation of the most modern type will be fitted. A system of wireless telegraphy will be installed. The machinery will consist of two sets of quadruple expansion engines, specially balanced to reduce vibration, cylinders 20 in., 28 in., 39½ in., 57 in. diameter by 33 in. stroke, running at 150 revolutions per minute. Steam will be supplied at a pressure of 215 lbs. per square inch by four large cylindrical boilers working under forced draught with air heaters, the air being supplied by two large fan engines. The machinery throughout is of the highest class and has been specially designed for the particular trade in which the vessel will be engaged by Mr. W. S. Hide, Messrs. Wilson's superintending engineer, and will indicate 5000 h.p. at sea. The whole of the engine and boiler-room arrangements are carried out on the most modern ideas for first-class passenger steamers.

Spilsby.—On April 11th, there was launched at Stockton-on-Tees a steel screw steamer of the following dimensions:—Length, 358 ft. 6 in.; breadth, 50 ft. 10 in.; and depth, 25 ft. 8 in. The vessel will be classed 100 A1 at Lloyd's. The engines, of the triple-expansion type, will be of about 1500 i.h.p., taking steam from two steel boilers 16 ft. by 10 ft. 6 in., 180 lb. steam pressure.

Sidi Brahim.—On April 11th, a finely-modelled steel screw steamer was launched from the Neptune Works of Messrs. Swan, Hunter & Wigham Richardson, Ltd. The vessel has been built to the order of the Société Générale de Transports Maritimes à Vapeur, Marseilles, for their mail and passenger service between France and Algeria. She is 325 ft. in length by 41 ft. broad, and is being built to attain the highest class in the Bureau Veritas (Mediterranean service). The propelling machinery consists of a set of four-crank triple-expansion engines, supplied with steam at 180 lbs. pressure from four boilers fitted with forced draught. They are expected to drive her at a speed of 17 knots per hour. The steamer has accommodation for fifty-eight first-class passengers amidships. In the poop are state-rooms for forty-five second-class passengers. Forward there is accommodation for thirty third-class passengers. The vessel will have an installation of wireless telegraphy and will be lighted by electric light. A Cochran (Annan) donkey boiler with patent seamless furnace has been fitted.

Graciana.—On April 11th, the Northumberland Shipbuilding Co., Ltd., launched from their yard at Howdon-on-Tyne, a finely-modelled steamer built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, to augment their fleet of fine steamers. The vessel is 365 ft. long by 51 ft. 4½ in. beam by 28 ft. 4½ in. deep, and has been built under special survey to the highest class at British Corporation. She is fitted with long bridge, long poop, topgallant forecastle, the accommodation, which is very ample, being placed in steel

houses on the bridge deck. This steamer has been specially designed with a view to rapid loading and discharging of homogeneous cargoes, the hatchways being very long and wide, and are arranged for grain carrying in bulk, a complete set of shifting boards being fitted throughout to latest Board of Trade requirements. Ample deck gear is provided, consisting of eight steam winches by Messrs. John Lynn & Co., Ltd., Sunderland, and a large number of cargo derricks to ensure the expeditious handling of cargoes. She is fitted with the usual water ballast arrangements for light passages. The machinery will be supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 40 in., 67 in. by 45 in. stroke, three large steel boilers with 180 lbs. pressure. This vessel will carry about 7350 tons on a light draught and steam about 10 knots loaded at sea.

Incentive.—On April 12th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw drifter, the principal dimensions being 83 ft. by 18 ft. by 9 ft. 6 in. moulded. The vessel has been built to the order of Messrs. C. & R. Harvey, Ltd., of Lowestoft, and will be fitted with powerful compound surface-condensing engines by Messrs. Crabtree and Co., Ltd., Great Yarmouth, and is replete with all the latest improvements for this class of vessel.

Golden Ring.—On April 12th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw drifter, the principal dimensions being 83 ft. by 18 ft. by 9 ft. 6 in. moulded. The vessel has been built to the order of Mr. W. T. Tripp, of Lowestoft, and will be fitted with powerful compound surface-condensing engines by Messrs. Crabtree & Co., Ltd., Great Yarmouth, and is replete with all the latest improvements for this class of vessel.

Janus.—On April 12th, there was launched from the yard of Messrs. Palmers' Shipbuilding and Iron Company a handsomely modelled steel screw cargo and passenger steamer, built to the order of Messrs. Archibald Currie & Co., Melbourne. The vessel is of the following dimensions:—Length, between perpendiculars, 400 ft.; breadth, moulded, 52 ft. 10 in.; and depth, moulded, 27 ft. 6 in. She has been constructed under Lloyd's special survey to class 100 A1, and is of the three-deck type, with 9 ft. 6 in. shelter deck all fore and aft. Accommodation is fitted on the promenade and shelter decks amidships for fifty-eight first-class passengers. The deck above is extended to the vessel's side, forming a promenade deck over 100 ft. long. Deckhouses are fitted for smoke-room, saloon entrance and social hall, captain's room, and chart-room. Accommodation is provided for thirty-two second-class passengers. Horses will be carried on deck. The vessel, which is lighted with electricity throughout, will carry about 7500 tons deadweight. She is fitted with triple-expansion engines, the cylinders being 28 in., 46 in. and 76 in. in diameter by 51 in. stroke. The steamer is the 806th vessel Messrs. Palmers have built, and the seventh steamer they have launched for Messrs. Archibald Currie and Co.

Cable-Laying Barge.—On April 13th, a cable-laying barge was successfully launched from the works of Messrs. Edward Finch & Co., Chepstow, to the order of Messrs. Siemens Bros., Woolwich, for laying and repairing the cable in Rio Harbour. Length overall, 95 ft.; breadth, 20 ft.; depth moulded, 6 ft. 6 in. The barge is also arranged for carrying 150 tons of cargo when not at cable work. All cable gear was dismantled after steam trial on Tuesday, and the barge will now be fitted up with mast and sails for sailing out to Rio.

Dewsbury.—On April 14th, Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull launched from their yard a handsomely modelled vessel built to the order of the Great Central Railway Co., for quick passenger and cargo service between the ports of Grimsby and Hamburg. The principal dimensions are:—Length, 265 ft.; breadth, 36 ft. extreme; depth, 18 ft. 6 in. moulded. The vessel is constructed of steel, and has been built under special survey to Lloyd's 100 A1 class, Board of Trade latest rules, and in accordance with the German Emigration Laws and the Hamburg Harbour Authorities' requirements. She is of the one-deck type with poop, long bridge, and topgallant forecastle. There is ample accommodation for passengers. The saloons are arranged on main deck, that for first-class extending to the sides of vessel. The lavatory accommodation is extensive, and the ventilation of these compartments has received special consideration. The arrangement and fittings of galleys, pantries, etc., are thoroughly up-to-date and include all the latest improvements. The vessel is provided with all necessary cargo gear for rapid loading and discharge, and will be fitted with a special type of steam, hand and telemotor steering gear. A complete installation of steam heating, electric lighting, bells, and telephones will be fitted. The machinery will consist of a set of triple-expansion surface-condensing engines having cylinders 22 in., 35 in., 60 in. by 42 in. stroke, indicating about 2000 i.h.p. Steam will be supplied by two large cylindrical boilers working at a steam pressure of 180 lbs. per square inch.

LAUNCHES—Scotch.

Storeton.—On March 22nd, the Ailsa Shipbuilding Co., Ltd., launched from their yard at Ayr the twin-screw ferry steamer *Storeton*, built for the Birkenhead Corporation. The dimensions of the vessel are 145 ft. by 32 ft. by 11 ft. moulded. She is built to Lloyd's special survey for river purposes and is intended for the fast passenger ferry traffic on the Mersey. She will be fitted by the builders with twin triple-expansion four-cylinder engines, supplied by steam from two navy boilers and is designed to attain a speed of 12 knots. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the ship's sides, frames, etc., in engine and boiler rooms, also double bottom, buoyancy chambers, bunkers, peaks and ballast tanks.

Loch Etive.—On March 24th, there was launched at Bowling a steel screw steamer of 300 tons, built to the order of Mr. John G. Stewart, Glasgow. Compound engines will be fitted on the vessel, which was named *Loch Etive*.

Saturnia.—On March 29th, there was launched at Scotstoun a large twin-screw steamer for Messrs. Donaldson Brothers, Glasgow, for their Canadian service. The new steamer will have accommodation for about 1250 passengers, and a feature in the arrangement of the cabins is that both second and third-class accommodation is entirely composed of two- and four-berth rooms. The smoke-room, ladies' room, music-room and the accommodation for second-cabin passengers will be all situated in the steadiest parts of the vessel. While special attention has been given to the fitting out of the *Saturnia* as a passenger steamer, ample provision is also made for the carriage of cargo. The vessel has been built to the highest class at Lloyd's and Board of Trade requirements. She will be fitted with wireless telegraphy, and a complete installation of refrigerating machinery will also be included in her equipment. The machinery consists of two powerful sets of triple-expansion engines, with steam supplied from six boilers. Messrs. Matthew Keenan & Co., Ltd., have secured the contract to cover the boilers and all steam pipes with their non-conducting composition.

Doris (steam yacht).—On April 9th, there was launched on the Clyde the new steam yacht *Doris*, which has been built for Mr. S. B. Joel. She is a vessel of 1000 tons Thames measurement, and is schooner-rigged with two pole masts. The dimensions of the vessel are:—228 ft. between perpendiculars; overall length, 270 ft.; breadth, 31 ft. The accommodation is very large and compact. The equipment of the yacht will be thoroughly up-to-date, and will include many new features. There will be six small boats, including two steam launches and a motor launch. The machinery will consist of two sets of triple-expansion engines, each having four cranks, with cylinders 16 in., 26 in. and 30 in. in diameter respectively by 20 in. stroke, driving the twin screws. There will be two return tube boilers. The bunkers are very large, giving a large cruising radius, and the vessel will be coaled through ports in the top sides. Messrs. Wailes, Dove & Co.'s bitumastic enamel was applied to the engine and boiler rooms, bunkers, cabin flats, and gutterways.

Kingstown.—On April 12th Messrs. Ramage & Ferguson, Ltd., launched from their yard at Leith the s.s. *Kingstown*, a finely-modelled steel screw steamer, length 181 ft., breadth, 27 ft. 6 in., depth moulded 13 ft. 5 in., which has been built to the order of Messrs. John Weatherill & Sons, of Dublin, and to Lloyd's highest class, with scantlings and plates considerably in excess of Lloyd's requirements, designed with large cubical capacity to carry 750 tons on a light draught.

The new ship has extra large self-trimming hatchways and is constructed with deep bulb frames and longitudinal stringers, giving clear holds for the stowing of bulky cargoes. A cellular double bottom is fitted throughout, and in addition she has large fore and after-peak tanks for water ballast. She is fitted with heavy deck machinery of the most modern type for the quick handling of cargoes. Her triple engines will be fitted by the builders, and are guaranteed to be capable of driving her at a speed of 10½ knots loaded. A Cochran (Annan) donkey boiler with patent seamless furnace has been fitted.

Madgeburg.—On April 12th, the Greenock and Grangemouth Dockyard Co., Grangemouth, launched a cargo steamer built to the order of Messrs. James Currie & Co., Leith, for their general cargo trade. The vessel's dimensions are:—Length, 235 ft.; breadth, 36 ft., and depth, 18 ft. 4 in. moulded. She is designed to carry a large cargo on a light draught. A special feature of the design is the large quantity of water ballast provided for in double bottom, peak tanks and deck tanks. The design also secures a very low nett tonnage. Triple-expansion engines for a good rate of speed will be supplied by Messrs. Richardsons, Westgarth and Co., Middlesbrough. As the vessel left the ways she was named *Madgeburg*. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering was applied to the tank top in boiler-room and their "Bitumastic" enamel to the bunkers, tank top in engine space and bilges fore and aft.

Eagle III.—On April 14th, Messrs. Napier & Miller, Ltd., launched from their yard at Old Kilpatrick, the handsomely-modelled saloon paddle steamer *Eagle III.*, built to the order of Messrs. A. & J. Inglis, Ltd., Pointhouse, for Messrs. Buchanan Steamers, Ltd., for their passenger and excursion traffic on the Clyde. The vessel is of the following dimensions:—Length, 215 ft.; breadth, 25 ft.; depth, 8 ft. 6 in., and has been built with two complete decks, the uppermost one forming a promenade the whole length of the ship. Ample accommodation for first-class passengers has been provided aft on the main deck, also dining saloon below fitted up in the latest and most approved style. Forward under promenade deck a spacious deck saloon is fitted for second-class passengers with ample seating accommodation. Special care has been taken by the builders to ensure every comfort for passengers, and the ventilation, lavatory accommodation and fittings generally, including life-saving appliances, being in the latest and most approved style and description. The vessel has been built under special survey to pass the Board of Trade No. 3 Certificate for passenger and excursion traffic, and will, they trust, prove a valuable addition to the fleet of river steamers. The ship was towed to the Kelvin where she will be fitted with her machinery by Messrs. A. & J. Inglis, Ltd., specialists in this class of work.

Canonbar.—Recently the Ardrossan Shipbuilding Co. launched the passenger and cargo steamer *Canonbar*, which they have built for the North Coast Steam Navigation Co., Sydney, N.S.W. The vessel, which is 185 ft. long, 32 ft. broad, and 12 ft. deep, has been constructed to the special class of the British Corporation, and is fitted with all the latest appliances. The engines and boiler are being supplied by Messrs. David Rowan & Co., Glasgow. The vessel, which was designed by Mr. Charles M'Allister, Sydney, has been built under the superintendence of Messrs. Paton & Hendry, Glasgow, agents for the North Coast Steam Navigation Co.

LAUNCH Irish.

Cheslakee.—On April 9th, there was launched at Dublin the steamer *Cheslakee*, built to the order of the Union Steamship Co., of Vancouver (B.C.). The vessel, which has been built to the highest class of the British Corporation, is of the following dimensions:—Length, 132 ft.; breadth moulded, 28 ft.; and depth moulded, 17 ft. 9 in. to awning deck. She is intended for service on the coast of British Columbia.

FOREIGN LAUNCHES.

Radioleine.—On March 26th, this vessel, built to the order of the Société Pétroles-Transports of Marseille, by the Société Anonyme des Chantiers et Ateliers de Saint Nazaire at their Rouen yard, was successfully launched. This vessel has been designed and superintended by Messrs. Flannery, Baggallay and Johnson, Ltd., of London, Liverpool and Rotterdam, and is of the following dimensions:—Length between perpendiculars, 350 ft. 1 in.; breadth extreme, 45 ft. 2 in., designed to carry 5000 tons deadweight, and is fitted with extra cofferdams and complete pumping arrangement for carrying three classes of oil at the same time, each of which can be taken in and discharged entirely separately by means of different pumps and pipe lines. The vessel has all the usual fittings for oil carrying vessels, including electric light, permanent steaming out pipes, vapour pipes, engine-room auxiliaries and has large bunker capacity. Engines are 24½ in. by 40½ in. by 66½ in., with a stroke of 48 in., built by the Société Anonyme des Chantiers et Ateliers de Saint Nazaire at their Saint Nazaire engine works, and are supplied with steam by two single-ended boilers under Howden's forced draught system. The vessel is built to the highest class of Bureau Veritas and Board of Trade requirements. The vessel is fitted with three duplex oil pumps of Messrs. Hayward-Tyler & Co.'s special design for dealing with oil cargoes. The same firm are also supplying the other duplex steam pumps on board.

Modena.—On April 12th, Messrs. The Laxevaags Engineering and Shipbuilding Co., Bergen, Norway, launched the s.s. *Modena*, built to the order of Ivar An. Christensen, Esq., Haugesund. The principal dimensions are:—Length overall, 230 ft. 6 in.; breadth, 35 ft.; depth moulded, 16 ft. 10 in. The machinery is also built by the Laxevaags Co., the cylinders being 16 in. by 25½ in. by 43 in. by 30 in. stroke, the working pressure 175 lbs. per square inch.

TRIAL TRIPS.

Scottish Prince.—On March 31st, the trial trips of the s.s. *Scottish Prince*, built by Messrs. Short Brothers, Ltd., Pallion shipyard, Sunderland, to the order of James Knott, Esq., for the Prince Line, Ltd., Newcastle, were held off the mouth of the Tyne. During the trials the machinery run with great satisfaction to all on board, the mean speed of 12½ knots being attained. (For particulars of launch, see February issue).

Prince Rupert.—The sea trials of this fine passenger steamship have recently been completed off the mouth of the river Tyne with every success. The ship has been built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, and engined by the Wallsend Slipway and Engineering Co., Ltd. The leading dimensions of the vessel are 320 ft. in length, 42 ft. 2 in. broad and 18 ft. to the main deck with a gross tonnage of 2,850. She has been built to the highest class under the British Corporation survey, also complying with the Board of Trade regulations for passenger steamers. On the trial trip the ship was fully loaded, and both on the measured mile and when running continuously for six hours she maintained an average speed of over 18½ knots an hour in spite of the conditions of weather not being entirely favourable. This speed is considerably in excess of what was guaranteed. The twin-screw triple-expansion engines with four cylinders and cranks are balanced on the famous Yarrow, Schlick & Tweedy system, ensuring perfectly smooth running. Even at the highest speeds there was complete absence of vibration in every part of the ship, so that she will doubtless be a very popular vessel when in service between Prince Rupert and Vancouver on the coast of British Columbia.

Brantford.—On April 6th, the fine steel screw steamer *Brantford*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, left the Tyne for her trial trip, which proved in every way satisfactory, and a speed of 11½ knots was easily obtained. (For particulars of launch, see April issue).

Mary Blake.—The powerful screw barge tug *Mary Blake* recently ran her official trial on the Thames. She is 71 ft. long and has a breadth of 19 ft. The stern is one large hollow steel casting of unique design and attachment, specially suited for the heavy barge work on the Thames. This has been so designed by Messrs. James Pollock, Sons & Co., of Lloyd's Avenue, E.C., that in the general appearance of the tug it cannot be discerned from the ordinary construction. Messrs. Pollock's patent stern frame entirely dispenses with the arch piece over the top of the propeller. The lines are

unusual, as they have no perpendicular framing and plating, the arrangement forming greater protection from the barges, and greater stability and steadiness. The masthead lamps have a new automatic arrangement, so that they can be used for down-river work, and also for going through bridges when the funnel is lowered, a novel feature that will greatly assist up-river navigation, and diminish the likelihood of collisions. The automatic feed pumps, steam reversing gear, new type of spring and slip tow-hook, semi-cross bunker, salvage and fire pump connections make this vessel the most up-to-date tug that Messrs. James Pollock have yet turned out. She is the most modern tug on the Thames. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the peaks, engine and boiler spaces and bunkers.

Graanhandel.—On April 11th, the steel screw steamer *Graanhandel* was taken on her official trial trip in Hartlepool Bay. She has been built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, by Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, for Messrs. The Scheepsvaart Maatschappij "Gylsen" of Antwerp. The dimensions of the vessel are 280 ft. 6 in. by 40 ft. 2 in. by 20 ft. 6½ in., and she has single deck, poop, bridge and top-gallant forecastle, and is built to British Corporation highest class. A double bottom is fitted throughout on the cellular principle, and the after peak is arranged as a trimming tank. The vessel is constructed with deep bulb-angle frames and longitudinal stringers, giving clear holds for stowing bulky cargoes. Four water-tight bulkheads divide the ship into five water-tight compartments; there are four large hatches with a steam winch to each, the bulwarks have been specially strengthened for the carriage of deck cargoes and the vessel is replete with all the latest improvements for loading and discharging expeditiously. A powerful quick-warping steam windlass is fitted forward, and steam-steering gear amidships, with hand gear aft and a large multitubular donkey boiler is also fitted. Accommodation for the captain, officers and engineers is arranged in deckhouses amidships, the crew and firemen being berthed in the forecastle. The cabins are heated with steam and the sanitary, ventilating and lighting arrangements are effected on the most improved lines. The machinery, which worked most efficiently throughout the trials, has been supplied by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, and the cylinders are 20½ in., 33 in., 54 in. by 36 in. stroke with two large single-ended boilers working at a pressure of 180 lbs. per square inch. The vessel attained a mean speed of 12 knots on several runs over the Whitley mile, and afterwards proceeded to Blyth to load. A Cochran (Annan) donkey boiler with patent seamless furnace has been fitted.

Koolga.—The new steamer *Koolga*, built at Dundee, for Mr. Thomas Cowan, Leith, has undergone her official trial trip. The vessel, which is intended for service between Dundee, Leith, Southampton and Treport, emerged from all tests imposed upon her with perfect success. (For particulars of launch, see April issue).

Bengrove.—On April 16th, the finely modelled steel screw steamer *Bengrove*, built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of Joseph Hoult, Esq., of Liverpool, underwent her trial, which proved highly satisfactory in every way. The vessel was under command of Captain Barber. (For particulars of launch, see April issue).

British Standard.—On April 16th, the s.s. *British Standard*, recently built by Messrs. Wm. Pickersgill & Sons, Ltd., of Sunderland, left the builder's yard for her trial trip. On the trial general approval was expressed at the results attained, the ship and engines giving every satisfaction, the speed obtained being 11¾ knots. After the trial trip the vessel proceeded to Barry to load.

Priestman. The s.s. *Priestman*, the last word in grab hopper dredgers, ran very successful trials on the East Coast recently. This vessel has extra large power and a dead-weight capacity of 375 tons, the hopper is loaded in a very expeditious manner by a heavy type of Priestman grab dredging crane, having spare grabs for the different types of material that the vessel may be called upon to dredge in the modern extension of the harbours and waterways around our coasts. The dimensions of the hull are 122 ft. by 26 ft. by 11 ft. 3 in., and the vessel is fitted with a return tube boiler 12 ft. dia. by 10 ft., and other details equip the vessel for rapid handling in restricted waters, which enable her to be as economical and probably more so than any existing ship of her type. The production of the s.s. *Priestman* was due to the progressive policy of the owner, Mr. C. H. Campbell, dredging contractor, of London, the construction being ably carried out by Messrs. The Smiths' Dock Co., Ltd. of Shields and Middlesbrough, and was the first vessel laid down at their extensive new works at the latter port. The arrangement of the details, the superintendence of the construction and trial trips were conducted by Messrs. James Pollock, Sons and Co., Ltd., of London. The Great Western Railway Co., with their well-known enterprise, were alive to the advantages of this dredger, and secured her, whilst still in the builders' hands, for further deepening work in Fishguard Harbour.

Jan Breydel.—This new Belgian turbine steamer recently ran her trials on the Clyde, and attained a mean speed of 24·30 knots on four runs between the Cloch and Cumbrae Lights and of 24·834 knots on the measured mile. On a run over the mile stern first the speed was 15·083 knots. The guaranteed speed was exceeded in all cases.

Octo. On April 18th, the s.s. *Octo*, lately launched by Messrs. Short Brothers, Ltd., from their shipbuilding establishment at Pallion Sunderland to the order of the Aktieselskabet Hekla of Christiania, left the Wear for her official trials. The machinery throughout the trial worked very satisfactorily. On the trial runs the steamer maintained a speed of 10½ knots. (For particulars of launch, see March issue).

BOARD OF TRADE EXAMINATIONS.

NOTE 1C denotes First Class 2C Second Class

February 25th, 1910.

Anderson, J. E.	2C	N Shields
Anderson W.	1C	Aberdeen
Bodin, F. H. ..	2C	Sunderl'd
Bracegirdle, T.	2C	London
Bradley, R.	2C	Hull
Brooker, J. G.	1C	Liverpool
Brown, F. J. ..	1C	London
Burnham, F. ..	2C	Sunderl'd
Caird G. A. ..	2C	Greenock
Clark, G. P. ..	2C	Aberdeen
Devonport J. H.	1C	Sunderl'd
Ewing, H. N. ..	2C	Liverpool
Gelley, T.	2C	N Shields
Givens, J. E. ..	1C	N Shields
Hogg, M. M. ..	2C	N Shields
Holmes, G.	2C	Aberdeen
Hunter, J.	1C	Aberdeen
Irwin, G. F. ..	1C	Sunderl'd
Jamieson, J. G.	2C	Greenock
Jesse M. H. ..	2C	London
Kinnear, G. S.	2C	Aberdeen
Manning, T. S.	1C	Hull
Mason, M. T. ..	1C	N Shields
Monro, J. J. ..	2C	Aberdeen
Murray, D.	1C	N Shields
Read, E. H. ..	2C	Bristol
Ruiz, D. P.	2C	Greenock
Shannon, S. ..	2C	Greenock
Stewart, J. W.	2C	London
Thirlwell, W. ..	1C	Sunderl'd
White, D. J. ..	1C	Liverpool
Will, W.	1C	Aberdeen
Wood, J. R. ..	2C	Liverpool
Gray, W. G. ..	1C	Glasgow
Graham, H. S.	2C	Liverpool
Houghton, R. R.	2C	Liverpool
Johnston, V. ..	2C	Glasgow
Johnston, A. ..	1C	Glasgow
Lawler, T.	2C	Liverpool
Mathieson, R.	2C	Glasgow
M'Cheyne, R. M.	2C	Glasgow
Morris, W. Y.	1C	Cardiff
Morton, C. S. ..	1C	Glasgow
Murray, C. J.	2C	Glasgow
Nikas, Andrew	1C	Cardiff
O'Donovan, J.	1C	Glasgow
Royal, A.	2C	South'ton
Surman, A.	1C	Cardiff
Shearer, W. ..	1C	Belfast
Taylor, George	2C	Glasgow
Thomas, D. W.	2C	Cardiff
Trail, J. E.	1C	Leith
Vener, John ..	1C	Cardiff
Wheeler, F. A.	2C	Cardiff
Wright, J. M. ..	1C	Liverpool

March 3rd

Adam, J. C.	1C	Glasgow
Austin, M.	2C	N Shields
Barker, W. T.	2C	London
Bell, Thomas ..	1C	N Shields
Bell, W. A. ..	1C	N Shields
Bell, Herbert ..	1C	N Shields
Blandford H. T.	1C	South'ton
Booth, George	1C	N Shields
Dainty, F. S. ..	2C	Liverpool
Daniel, T. F. ..	2C	Liverpool
Ferry, E. S. ..	1C	N Shields
Fulcher, R. G.	1C	Glasgow

March 10th

Algar, William	2C	Hull
Allan, Robert ..	2C	Greenock
Balmer, H. S.	2C	Liverpool
Blair, William	2C	Greenock
Bridson J. H.	1C	Liverpool
Chalmers, W. F.	2C	Dundee
Crawford J. M'F.	2C	N Shields
Craig, John D.	1C	Greenock
Dalziel, W.	1C	Greenock
Dick, Ernest F.	1C	Hull
Downing S. H.	1C	Hull
Embleton M. H.	1C	N Shields
Ennis, Victor ..	2C	N Shields
Elliot Charles	[illegible]	N Shields
Gemmell, W.	2C	London
Gordon C. B.	2C	Dundee
Hill Percy	2C	London
Jenner, H. J.	1C	London
Langlake, T. ..	1C	N Shields
Malcolm T. ..	[illegible]	Greenock
Martin M.	2C	Greenock
Mitchell H. G.	1C	London
M'Callum, H.	[illegible]	Greenock
M'Lachlan J.	[illegible]	Hull

Munro, C. A. .. 2C London
Myhill, W. C. 1C London
Nicolson, W. B. 1C Dundee
Pickering, J. H. 2C Liverpool
Ramsey, P. H. 2C Dundee
Robb, William 2C Greenock
Rutherford, E. P. 1C Liverpool
Simpson, R. N. 2C Greenock
Stephenson, T. H. 1C Liverpool
Swindale, T. H. 1C N. Shields
Woodhill, T. G. 1C Liverpool

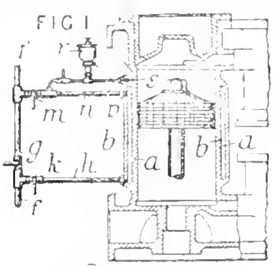
March 17th

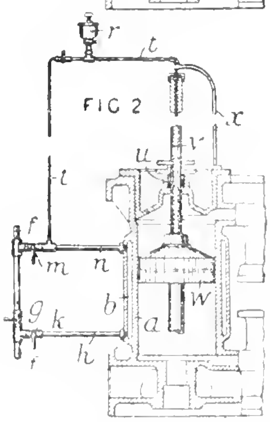
Adam, Alex. .. 1C Leith
Bateman, S. H. 2C N. Shields
Beckett, R. G. 2C London
Brade, G. .... 2C Liverpool
Bolton, A. E. .. 1C Liverpool
Buckwell, E. G. 2C Liverpool
Campbell, J. .. 2C Glasgow
Deane, R. .... 2C South'ton
Donald, J. .... 1C Glasgow
Downie, D. M. 2C N. Shields
Dyer, H. R. .. 2C South'ton
Eades, A. L. .. 2C South'ton
Gallon, T. .... 1C W. Hart'l
Goddard, C. G. 2C N. Shields
Gordon, W. .. 2C Liverpool
Hardie, F. ... 2C Glasgow
Hogan, R. H. 2C Cardiff
Holmes, A. .... 1C Glasgow
Hughes, A. H. 1C South'ton
Hurworth, J. P. 1C W. Hart'l
Ions, R. M. .... 1C W. Hart'l
James, H. R. .. 1C South'ton
John, S. P. .... 2C South'ton
Johnson, F. M. 2C W. Hart'l
Johnstone, O. 1C Cardiff
Keddie, J. .... 1C N. Shields
Kirk, C. S. .... 1C W. Hart'l
Mackenzie, H. 1C London
Mellowes, A. .. 1C Liverpool
M'Burnie, S. C. 1C Liverpool
M'Intosh, W. D. 1C Glasgow
M'Kevitt, J. T. 2C Cardiff
Nettell, R. .... 2C Plymouth
Nicoll, James .. 2C Glasgow
Ray, A. R. .... 1C W. Hart'l
Rennie, W. .... 2C Liverpool
Renton, E. L. 2C N. Shields
Seago, A. G. .. 1C W. Hart'l
Scott, J. D. .... 2C London
Stephen, J. .... 2C Leith
Spathis, P. .... 1C N. Shields
Tait, E. V. .... 1C W. Hart'l
Thomson, D. W. 1C N. Shields
Walker, H. P. W. 1C N. Shields
Wilson, J. H. .. 1C Leith
White, F. G. W. 2C Cardiff

The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs. E. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

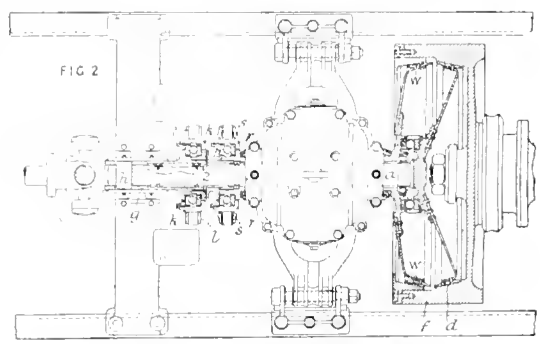
No. 24454. Lubricating. A cylinder for a marine engine, etc., working with superheated steam is lubricated by a film of water, which is condensed on the cylinder walls by means

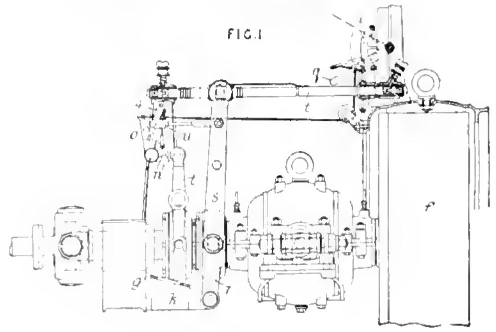




of a cooling-jacket or a coil system, through which steam or water at the required temperature is led. In the arrangement shown in Fig. 1, the feed-water pipe f is connected with a cylinder jacket b by pipes h, n, cocks g, k, m being provided so that the whole or part of the feed-water passes through the jacket. A part of the water may be admitted to the cylinder a through a pipe p and one or more openings s, and may be mixed with graphite or other easily-separable lubricant from a vessel r. Fig. 2 shows a modification in which the pipe p is replaced by a pipe t connected to a passage u in a continuation v of the piston-rod. The passage u branches into radial passages w through which water is discharged on to the cylinder wall. The pipe t is supported by a standard x.

No. 24857. Propelling Ships, etc. Driving Gear for Screw Propellers.—Comprises improvements in driving-gear in which the thrust of the screw propeller is utilized to engage a clutch between the driving-shaft and the propeller shaft, by means of an axial displacement of the propeller shaft. An adjustable device is interposed between the propeller shaft and the driving-shaft so that the clutch may be engaged gradually. The driving shaft (a) carries a clutch (d) engaging the fly-wheel (f). The displacement of the sleeve (g), which is connected to the propelling-shaft, is limited by the cotter (h) and the ring (i), loose on the shaft (a). The sleeve (g) is provided with a loose ring (k) operating a lever (l). When starting, the lever (s) is operated by the screw (t) and, by means of the ring (i) puts the clutch (d) into engagement, driving the propeller shaft through the keys (2) and the sleeve (g). The thrust produced moves the lever (l) until its upper end bears against





the adjustable cam (m), actuated from the handle (q). Simultaneously the lever (s) moves the cam (n) through the link (u) and levers (4, o), so that the thrust of the propeller may gradually apply pressure to the clutch (d). By moving the lever (q) the sleeve (g) may be permitted to transmit thrust directly to the sleeve (r) and thence to the clutch (d). Disengagement is effected by the movement of the lever (s) in the opposite direction, and continued movement in this direction reverses the rotation of the propeller shaft by engaging the clutch (w). In a modification, a double cone clutch is mounted on the casing of a set of planet-wheels, engaging either with a fixed ring for reverse drive or with the motor fly-wheel for ahead drive, and geared to the driving shaft. The adjustable device comprises a helical spring which is compressed by the thrust of the propeller until the propeller shaft is permitted to move the driving-shaft into engagement with the friction clutch.

The Marine Engineer
And Naval Architect.
LONDON, JUNE, 1910.

THE DEATH OF KING EDWARD VII

SINCE our last issue the nation, and we may say the world, has been suddenly plunged into sorrow and mourning by the wholly unexpected death of King Edward VII. The blow was so sudden as to cause from this reason alone a wave of deepest sympathy over the whole of the civilised world. However, the matter does not rest there, for by a persistent effort in the cause of peace, which has justly entitled him to go down to posterity as Edward the Peacemaker, he not only won the deep love of his people, but he secured a high place in the affections, good opinion and respect of foreign nations. Much has been said during the last few weeks of his life's work, but what stands out more prominently than anything else is the complete manner in which he carried out the resolution made on his accession, *viz.*: "I am fully determined, as long as there is breath in my body, to work for the good and amelioration of my people." Having lived so many years in the reign of his august mother, the late Queen Victoria, during which the commercial interests and industrial development of this country had made such vast strides, it is not surprising that he took a real and active interest in the arts and sciences to which that advance was due. As far back as 1865 he accepted the Honorary Membership of the Institution of Civil Engineers; in 1888, that of the Iron and Steel Institute; in 1890, that of the Institution of Mechanical Engineers; and in 1895, that of the Institution of Naval Architects. In 1863 he became a life member of the Society of Arts, and was its President until his accession to the throne in 1901, when he was graciously pleased to become Patron. His personal association with many of the engineering triumphs of his time show his appreciation of the benefits to mankind secured by scientific progress. In 1860 he opened the tubular bridge over the St. Lawrence in Montreal; in 1870, the Thames Embankment; in 1879, the Grimsby Docks; and in 1886, the Mersey Tunnel. In 1879 he laid the foundation of the new Eddystone Lighthouse, and in 1886 the first brick of the Tower Bridge, which he opened in 1894. The year 1890 was signalized by him in driving the last rivet in the Forth Bridge and opening the bridge, and performing the opening ceremony of the City and South London Railway, which was the pioneer line of its kind in London, and from which the rest of the tube railways have developed. After ascending the throne he launched the *Dreadnought* in 1906, and opened the Royal Edward Dock at Avonmouth in 1908. It must, we think, be recognised that King Edward had a strong commercial instinct, as it was due to his initiation that the Industrial Exhibitions in the eighties were held, the success of which was largely due to the keen and active interest he took in them. The eloquence of the foreign tributes to his great powers, keen intellect and sagacious rule point strongly to the fact of the great part he has taken as a King, and, above all, as a man among his fellows.

KING GEORGE V

WE think that the nation should be thankful that in King George they have a monarch who has been carefully trained by his august father for the position he occupies. There has never been a monarch who has seen more of the world than King George, and the knowledge gained in his travels must of necessity stand him in good stead in carrying out the various responsibilities of his position. It may be truly said he is our Sailor King. He has served a useful apprenticeship and has had an active life in the service of the country as an officer of the Royal Navy for a number of years. At the age of twelve he joined the training ship *Britannia* in 1877, and from 1879 to 1882 he was on the cruiser corvette *Bacchante*, during which time he travelled practically all over the world. In 1883 he was a midshipman on the corvette *Canada* and received the rank of acting sub-lieutenant, in 1884 he proceeded to the Royal Naval College at Greenwich, and thence passed to H.M.S. *Excellent* in 1885, when he was promoted to lieutenant. In 1886 he was appointed to the *Thunderer* and *Dreadnought* in turn, in 1888 to the battleship *Alexandra*, and in 1889 to the battleship *Northumberland*. It was in this year that he received his first command, *viz.*:—Torpedo boat No. 79, and in 1890 was appointed to commission the screw gunboat *Thrush*, being promoted to the rank of commander in 1891. During the naval manœuvres in 1892 he commissioned the cruiser *Melampus*, of which he was acting-captain, and received the rank of captain in 1893. When departing for the Colonial tour in 1901 he was specially promoted to the rank of rear-admiral, in 1903 promoted to vice-admiral, and in 1907 to admiral consequent on Sir A. Wilson being made Admiral of the Fleet. It will thus be seen that King George has had 33 years' continuous association with the Royal Navy. We think it desirable that the nation should have the naval history of His Majesty before it so that it can appreciate the fact that the successive ranks attained have been due to actual service, and not as a compliment to a prince of Royal blood. With the cumulative experience attained in this lengthy career, no doubt can be entertained that the honour, usefulness and efficiency of the navy will be a strong feature of King George's influence in maritime matters. We believe that the King has no more loyal subjects than those who make

their living on the great waters, and to them His Majesty may, we feel certain, look with confidence for that devotion to duty, loyalty of purpose and deep sense of responsibility on the part of all branches of the navy and mercantile marine which the best traditions of this country demand, and the integrity of the empire renders absolutely necessary. May King George have a long and prosperous reign is a prayer which has risen from his subjects all over the world.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

THE inauguration ceremony in connection with the opening of the new premises of the North-East Coast Institution of Engineers and Shipbuilders at Newcastle on May 23rd recalls the incidents clustering around the beginning of the Society and its foundation in 1884. The publication of a letter pointing out the advantages likely to accrue from a Society formed for the purpose of discussing technical subjects of common interest to engineers and shipbuilders, and advocating the establishment of such, was as the spark that lighted the slumbering fire of desire for what was forecasted in the letter, which was signed "T Square." A reply appeared next day from Mr. W. Boyd, of the Wallsend Engineering Co., expressing approval, and inviting the writer to make himself known so that negotiations might be opened. The writer of the letters proved to be Mr. W. G. Spence, then with Messrs. R. & W. Hawthorn, and now manager at the Neptune Engine Works, Walker. A meeting was called, a committee was formed, then the Society started with Mr. W. G. Spence as Hon. Secretary and Mr. William Boyd as President. The late Mr. B. G. Nichol was also elected Hon. Treasurer. The objects of the new institution were set forth as "The advancement of the science of engineering and shipbuilding, and the interchange of ideas and information among its members by means of meetings, for the reading and discussion of papers relating thereto, and placing on record its transactions." The reports of the first meetings held with a view to form and establish the institution were fully reported in our issues of November and December, 1884. Mr. Boyd delivered the inaugural address in the Lecture Hall of the Literary and Philosophical Society on Nov. 28th, 1884, explaining the objects of the society, the leading aims of the founders, and their hopes and aspirations. He referred to the changes then taking place, or but recently introduced, in marine practice, and calling for consideration and discussion with a view to further improvements and extension, such as the hydraulic system for cargo purposes, its ease in working, with other advantages; the electric current for ship lighting and its capabilities for more extended uses; forced draught for marine boilers, at that time in its early stages of experimental developments, higher boiler pressures following upon the triple and quadruple engines then being fitted in steamers, and showing reduction in coal consumption, with the posssibilities in respect to smaller capacities to obtain the horse-power required; economy in working and in production by improvements in system and machinery; cheapness in workmanship and material considered in relation to true economy, etc., each and all of these subjects being thus referred to in the inaugural address shadowed forth the papers and discussions which followed. The institution forged ahead on the path of progress, and at the end of the first year a membership of 450 was reached, now the roll is 1,200. Mr. W. G. Spence found other claims pressing upon him, and was compelled to retire from the position of Hon. Secretary, and Mr. Duckitt was appointed Secretary. The Institution has given a healthy encouragement to the rising generation in the direction of technical education by establishing a scholarship fund, out of which scholarships are granted to graduates of the Institution for Engineering and Naval Architecture, and the close proximity of the Armstrong College, Newcastle, is a great boon to the young engineers and shipbuilders. The list of past presidents is as follows:—Mr. W. Boyd, Sir Theodore Doxford, *Mr. F. C. Marshall, *Mr. J. Wigham Richardson, *Mr. Robert Thompson, *Sir Thomas Richardson, B.B., *Col. H. F. Swan, C.B., Sir Benjamin C. Browne, D.C.L., Mr. Henry Withy, Mr. John Tweedy, Lord Armstrong, M.A., D.C.L., Mr. W. H. Dugdale. The occasion of the opening of the new premises was made the opportunity of presenting to Mr. Boyd, the first President of the Institution (1884 to 1886), a marble bust of himself. The photographs we reproduce on another page to commemorate the event just celebrated in the history of the Institution are portraits of the first President (Mr. Boyd) and Hon. Secretary (Mr. Spence), of one of the members of Council who did excellent work in helping to bring the Society into shape (Mr. C. W. Hutchinson), of the retiring President (Mr. Summers Hunter), of the President-elect (Colonel R. Saxton White), and of Mr. J. Duckitt, who has been the Secretary of the Institution since shortly after its formation and still serves in the same capacity.

THE WATCHING OF OUR COASTS.

THE protection of life and property relative to vessels in our home waters is in every sense a national question, particularly having regard to the large number of vessels employed in and the value

* Deceased.

WILLIAM BOYD, ESQ., J.P.

First President of the North-East Coast Institution of Engineers and Shipbuilders, 1884-1886.

of cargo carried for the purpose of commercial operations. It will be remembered that in December last the s.s. *Thistlemor*, of the Albyn Line, left Cardiff with a cargo of coal, and during a storm was sunk in Bideford Bay with a loss of twenty-one lives, including her captain. The Board of Trade instituted an inquiry, which was held last month, and the findings of the court do not afford very pleasant reading to those interested in maritime matters, so far as shore assistance is concerned. The history of the matter as set out in the judgment is very simple indeed. The coastguardsman on watch at Peppercombe saw lights at 4 a.m., which fact he telephoned to Clovelly at 4-15 a.m., where the man on duty who received the message considered they were signals for a pilot. This man neither passed on the report to his superior officer to get his opinion on the matter, nor did he ring up Hartland Point to make enquiries, as he promised the coastguardsman at Peppercombe to do on receiving the report at first. Several lights were again seen by the man at Peppercombe, who rang up Clovelly at 4-50 to further report, but could get no reply. In spite of this he failed to fire a rocket, and if he had done so the situation might have been saved. Between 5 and 6 a.m. the lighthouse-keeper at Hartland Point saw a blue light, but nothing appeared to have been done. At 6-20 a.m. people on Clovelly Pier saw a blue flare about six miles off, and took prompt steps to call out the lifeboat, which was skilfully got away, and had proceeded some distance under oars by the time two rockets were fired for summoning the crew. In spite of the splendid handling of the boat by the coxswain she arrived too late, as the *Thistlemor* had sunk with her master and twenty of her crew. This result, in the opinion of the Court, was due to the hesitation and want of initiation shown by the coastguard watchman at Peppercombe at or after 4.50 a.m. on the one hand and the gross neglect of duty on the part of the coastguard watchman at Clovelly, to whom the report was made at 4.15 a.m. from Peppercombe, on the other hand. A further point of importance was brought out in the fact that the three watchers at Hartland Quay were agricultural labourers who had already done a day's work before undertaking watching duties. Could a more unsatisfactory state of things be disclosed? The responsibility for the system in vogue, or want of it, is difficult to fix. As the coastguards are under the Admiralty, the Board of Trade is supposed to look after the safety of life at sea, while the lighthouses are in charge of the lighthouse boards. Surely the time has arrived when the watching of our shores should be carried out in a more satisfactory and efficient manner than appears from the *Thistlemor* enquiry, and we feel certain that the apologetic explanations given by the Admiralty representative will cause genuine regret and dismay in the hearts of those who consider that the watching of our coasts is a paramount national duty. Let us look to it, and have the system improved, or substitute some other in its place, and lastly, to have the responsibility as to efficiency clearly defined.

THE "WARATAH

ANY hope of news of the ill-fated *Waratah* has long since vanished, and the public have waited with respectful silence the return of the search vessel from its fruitless expedition. We understand now that the British Board of Trade has made a move in the matter by communicating with the Registrars of Shipping in Melbourne, Sydney and Adelaide, which latter were the Australian ports of call of the steamer, requesting a thorough investigation into all the matters relative to the vessel on leaving these ports and to the voyage from Australia to South Africa. In order to make the investigation as complete as possible a similar request has been made to the authorities at Durban. We believe that Capt. Hacking, the Superintendent of Navigation, has already commenced taking evidence on the matter at Sydney, so that no time is being lost. It would appear that the enquiry will deal with such matters as the description of cargo and weight loaded and unloaded at the three Australian ports, in order to ascertain the weight of cargo on board when the ship sailed; the weight of bunker coal loaded at those ports; the amount of cargo loaded in each hold, and how and where stored and secured; the carrying of cargo or bunker coal on deck and, if any, how secured; the draught and freeboard on leaving each port, and whether the vessel was upright on each occasion. In addition to the fullest information being sought as to the crew and passengers carried, reports are to be obtained from the pilots who took the vessel to sea, on the condition, trim and behaviour of the ship and state of the sea, while evidence is to be obtained from passengers as to their experience, particularly from those who left the ship at Durban and returned to Australia, and from comments written in letters received from passengers on the voyage. It would seem that no stone is to be left unturned to collect all the information possible in order to arrive at some reasonable conclusion as to the cause of the disaster, but the fact will remain that in spite of all effort no positive evidence will ever be forthcoming as to what really did happen; it can only be surmise at the best, and can afford no consolation to the relatives and friends of the unfortunate victims, but may enable some preventative measures to be adopted against conditions likely to cause a repetition of such a calamity.

MOTOR ENGINES. Messrs. R. Wilson & Sons, of Tyne Dock, are to supply to a Company in China two [illegible] h.p. marine motor engines.

MODERN SHIPYARD MACHINERY AND EQUIPMENT.

IV.

Building Berth Equipment.

(*Continued from page 384*).

WHILE the great evolution in the size and power of ships which has taken place during the last two decades or so has necessitated a corresponding growth in the character and calibre of machine-tools for dealing with the heavier and more complex scantlings going towards their structure, there has been even more marked development in the capacity and character of the appliances needed to lift and transmit the structural items at the building berths. Electricity, as has been pointed out, besides creating to a great extent new needs and modifications of old practices, in these directions, has enormously aided in the realization of the present advanced stage of evolution. Taking the place of the ordinary derrick posts and jibs erected at convenient distances along each side of the building berths—even where these have been associated with hydraulic hoists or steam winches instead of the old methods of manual and horse haulage at ground level—overhead electric travelling cranes, supported on steel standards and runways, travelling the whole length of building berths, have within recent years been installed in many shipyards—first in America and Germany, then in Britain. These not only lift and transport structural items to their places in the ship's hull underneath, but support and transport the heavy mechanical appliances—electric drills, hydraulic and pneumatic riveters, etc.—now necessary to efficient construction. Ariel rope-runways instead of rigid girder runways have in some cases been adopted—as, for example, in the case of the Palmer yard at Jarrow-on-Tyne. The rigid system of crane equipment over berths has perhaps reached its fullest development in this country in the yards of Messrs. Swan, Hunter & Wigham Richardson on the Tyne (where the system was earliest adopted), and in the yards of Messrs. Doxford & Sons, Sunderland; Messrs. Vickers, Sons & Maxim, Barrow; Messrs. Beardmore & Co., on the Clyde; and Messrs. Harland and Wolff, Belfast. The elaborate and highly efficient systems of equipment in the shipyard of the latter firm, underneath which the mammoth White Star liners are being constructed, have already been described and illustrated in our pages.

Nothwithstanding that many of the larger shipyards, noted for their up-to-date equipment and appliances, have now these imposing erections over their building berths, carrying travelling electric cranes of various kinds and power, other establishments, no less up-to-date, seem to have decided that the balance of advantage, all things considered (economy of first cost as well as efficiency of working character), lies with arrangements not quite so radically different from those which have so long proved serviceable. Stationary derrick posts, at intervals along each side of the berths, have, as already stated, long been features in many yards, and these are being perpetuated, with minor modifications, which render them more in keeping with modern ideas of capacity and celerity of working. In some cases, hydraulic hoists have been an integral part of these derricks, seeing that the hydraulic system of power was being used for other purposes alongside; but with the same thing obtaining in connection with electricity as a motive power, the tendency now is for electric hoisting arrangements, instead of the slower, although equally powerful, hydraulic or pneumatic arrangements.

The change is more easily made, and certainly far less costly, than the elaborate standards and girders, which form so imposing a feature in many large establishments. Provided the stationary derrick posts are properly placed, and have all their working details adapted to the methods of work prevailing, there is much to be said for the system, even should celerity in working in occasional cases be inferior to the other crane equipment referred to. In this connection, it is noteworthy that the Fairfield Shipbuilding Co., Govan, have lately been supplied with four electric derricks capable of lifting five tons at a radius of 40 ft. and at a height of 1[illegible]0 ft. above the ground level. These derricks are self-contained, and consist of a vertical mast constructed of steel lattice work, which is held in position by inclined guys, and to which an inclined jib is attached near the top. The electric winch for raising the load is situated within the vertical mast at about one-third of its height, and the slewing mechanism is situated at the level of the springing of the jib.

In this apparent conservatism, or even reversion to methods which would seem to be "behind the times," Fairfield is not alone, because in the building of the battleship *Colossus*, recently launched by Scott's Shipbuilding Co., Greenock, stationary electric derricks of a like kind were utilized, and it may be recalled that, in the building of the *Lusitania* some five years ago, Messrs. John Brown and Co., Ltd., Clydebank, specially installed, alongside the building berths, two electric derrick post and jib stationary cranes, near the forebody of the great ship, which were in all essential features similar to the cranes which Fairfield had just installed in the works, and which were supplied by the same makers, Messrs. Sir Wm. Arrol & Co., Ltd. With these two special derrick jibs, which dealt with a maximum weight of four tons, and with the ordinary jibs in timber uprights for dealing with the light loads, and with the necessary concomitant of means of transporting the material lifted to the proper *locale* in the structure of the ship, the remarkable work of constructing the great ship was carried on without a hitch and with all the celerity needed. The weights when lifted were moved on waggons on a standard gauge railway laid on the deck plating. At a time when so much is spent by some firms on elaborate berth structures, the methods outlined may seem extremely crude. Comment, however, is unnecessary here in view of what is being adopted at this later date, as well as in view of the short period occupied in the building of the Lusitania. This vessel, whose launching weight was 15,500 tons, was sent off the stocks fourteen months three weeks from the laying of the keel, in spite of the fact that there was eight weeks' delay due to a workmen's strike.

Given an establishment in which electricity for power purposes, as well as for lighting, is in use, it necessarily follows that if current is applied to the operation of one class of appliances—travelling cranes over the building berths for example—it will be utilized for as many purposes as possible in the same domain. Alongside building berths, and associated with derrick posts of constructional steel or of timber, it is now usual to find capable and efficient hoisting and haulage winches, which may be either fixed in one position or easily shifted, as well as electric haulage capstans in fixed position, with working gear entirely underground. We now proceed to describe and illustrate a selection of examples of such appliances, made by firms well known for this class of production.

In Fig. 1 is shown a good example of a shipyard winch such as is referred to. This is a three-ton winch of Messrs. Clarke, Chapman & Co.'s make, which has been supplied to numerous firms in this country and on the Continent. Winches similar to that illustrated, but of a larger size and power, are installed in the yards of Messrs. John Brown & Co., Clydebank; The Fairfield Co., Govan; Scott's Shipbuilding & Engineering Co., Greenock; Messrs. Armstrong, Whitworth & Co., Newcastle-on-Tyne; and also in some of the Imperial Dockyards in Japan. This three-ton electric winch, it will be seen, has double warping ends, which allow of a speed being used suitable to the load. The barrel is independent of the shaft, which gives greater freedom in handling loads. The winch is arranged with the motor driving barrel and warp-ends through three sets of spur gear. The motor pinion is of bronze engaging with a machine-cut cast-iron wheel. The barrel, being loose on the shaft, is fitted with a clutch for throwing it into gear. A foot-brake with screw is provided, which allows of a load being held suspended from the barrel, while the warping drums are being used, and a foot-brake on the motor pinion controls the latter. The warp-ends are provided with two diameters, the small end giving a speed of 40 ft. per minute with three tons, and the large end a speed of 80 ft. per minute with one and a half tons.

The motor is of 12 B.H.P., and as it is series-wound, light loads can be lifted at faster speeds. A tramway type reversing controller and the resistances are mounted on the bedplate, making the winch self-contained, the whole being of a substantial design, well calculated to take the strains coming on it.

Fig. 2 illustrates a three-ton electric worm-geared winch,

also by Messrs. Clarke, Chapman & Co., and installed in several home and foreign yards. This worm-geared type of winch is specially adapted for shipyards, as the motor, resistances and gear are all completely enclosed. The two warp-ends are driven by the motor through a worm reduction, and lift three tons at a speed of 50 feet per minute. The worm is single threaded, forged solid with its shaft, and coupled directly to the motor shaft. It engages with a machine-cut bronze rim, the whole gear being contained in a cast-iron case filled with oil and provided with a special roller bearing for taking the end thrust. The load is controlled by means of a foot-brake fitted to the worm-shaft. The motor develops 20 B.H.P., and it, together with the resistances, is protected from the weather by a removable cast-iron cover provided with lids for ready access. The controller is of the reversing tramway type, with a watertight joint between it and the bed, the connections being taken from it through a mound, cast on the bedplate and opening inside the protecting covers.

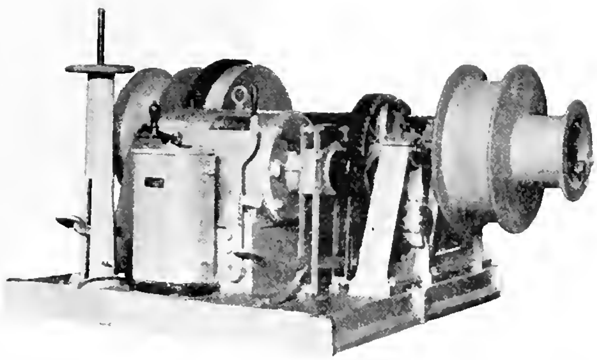


Fig. 1.—3-ton Spur-Geared Winch for Shipyards.

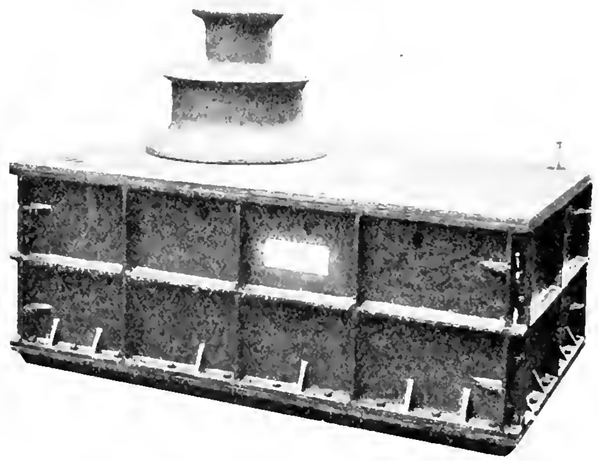


Fig. 3. 10-ton Two-Speed Capstan for Shipyards.

Fig. 3 illustrates a ten-ton two-speed electric capstan of Messrs. Clarke, Chapman & Co.'s make and now at work in a number of shipyards on the Clyde and North-East coast districts, *e.g.*:—Scott's Shipbuilding & Engineering Co., Greenock, and Messrs. Doxford & Sons, Sunderland. This capstan is capable of exerting a pull of ten tons at a speed of 30 ft. per minute, and as the barrel is made with two diameters, a speed of 60 ft. per minute can be obtained when the capstan is exerting a pull of five tons. The motor develops 35 B.H.P. when running at 600 revolutions per minute, and is operated by a barrel-type controller, having a removable foot pedal which projects above the capstan box. The speed of the motor is reduced to that of the capstan barrel by means of a worm and spur gearing. The worm is double threaded and is forged solid with its spindle and coupled directly to the motor shaft. The worm wheel has a machine-cut bronze rim, and runs in a substantial cast-iron box filled with oil, a special roller bearing being fitted to take the end thrust. The spur gearing is of cast steel. The motor, controller and gearing are enclosed in a strong cast-iron box, which is quite able in itself to take all the strains due to the 10-tons load. When specially specified a magnetic brake is supplied.

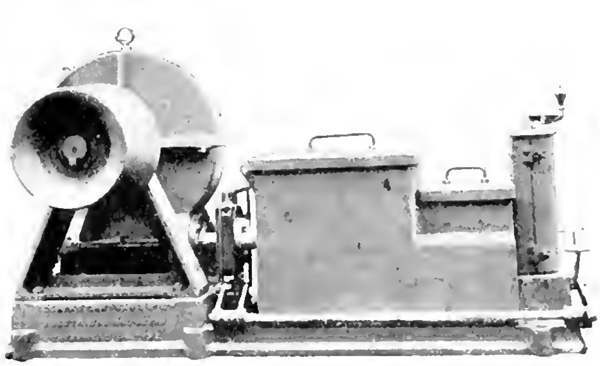


Fig. 2.—3-ton Worm-Geared Winch.

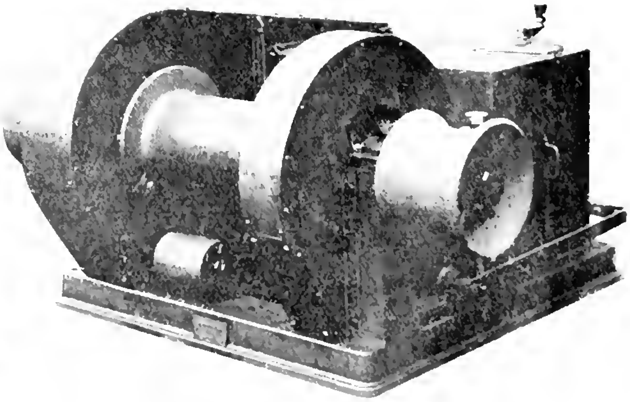


Fig. 4. Electric Shipyard Winch.

While the usual pattern of shipyard winch with parts exposed and guards over gearing is produced by Messrs. Chambers, Scott & Co., Motherwell, this firm are now calling more direct attention to their special make of "steel clad" type of shipyard winch, as illustrated by Figs. 4 and 5, in which all the gear is entirely encased, only the drums and operating levers being visible. The chief advantage claimed by the makers is the protection from weather and mechanical injury

afforded by their arrangement, while at the same time suitable provision is made for access to parts, dismantling being readily effected when necessary.

The drums in this design of winch are driven through a set of spur or worm reduction gear by motor and operated by a controller, the bearing brackets, etc., being all mounted on one sole plate with built steel coverings neatly fixed over the gearing, motor, etc. These winches are fitted with centre and end drums or simply with Bollards, and the gear wheels are machine cut from solid rims, keyed and mounted on turned mild steel shafting working in gun-metal bearings. The breaking of gear is usually effected by foot lever band brake, but when desired a safety automatic magnetic brake is provided, electrically interconnected with controller, which actuates same irrespective of operator, instantly holding the gear when current is switched off or suddenly interrupted from any cause.

The motors adopted by Messrs. Chambers, Scott & Co. for this class of work are of their crane type, completely enclosed, very liberally rated and capable of withstanding heavy and sudden overloads. Being specially designed for cranework, these machines can start against the full load under perfect control, and run without sparking at brushes at any load. The insulation throughout is thoroughly sound, both mechanically and electrically, non-inflammable, and the armature bearings are of gun-metal and self-oiling, and the brush gear is of the self-adjusting block pattern. For starting, reversing and speed regulation of motor, a drum type controller is provided, conveniently arranged for operator, and equipped with large copper contacts to counteract the wear on these part, giving a wide range of speeds and full control at all loads. The speed regulating resistances used are similar to what the firm supply with their ship's lifting machinery, *viz.*, of non-corrosive material, and arranged so that damage by breakage is reduced to a minimum. The cables connecting the motor and controller are of high-grade vulcanized rubber, while safety cut-out fuses and enclosed switch are provided to protect the circuit from overloading or careless handling. Every care is taken to make these winches practically "fool-proof"; the parts are all substantially fitted together, and screw-down lubricators, all get-at-able, are fitted to the main bearings. Chambers, Scott & Co. make many varieties of these designs to efficiently handle any load, both for direct or alternating current and special control for special service. These winches are built also on wheels for portability.

Intended to take the place of the usual stationary derricks and partake of the advantage of the overhead craneways or of the aerial rope-walk now in use, Messrs. Babcock and Wilcox have designed and supplied to shipbuilders—*e.g.*, Messrs. Craggs & Son, Middlesbrough—a special travelling jib crane, of which we give two illustrations.

This crane, which has a number of special features, is electrically operated and is on a tall carriage constructed in such a way that it will work on a track in between ships' berths and so that ordinary travelling cranes or railway trucks will pass underneath it, thus using the minimum amount of available space in the berth. The crane is of the luffing type, and has a jib 60 ft. long, which is balanced by means of a travelling weight and compensating arrangement in the column, and it can be used on long or short radius either above or below the horizontal line, as will be gathered from a comparison of the two illustrations we give. The advantage of this is apparent to those accustomed to this sort of work. If a load is suspended on a very long rope from the jib-head of a crane, or from an overhead ropeway, the wind, or the fact of travelling or moving the crane, gives the load a swing, or surge, making it very awkward and dangerous to handle the plates and scantlings. With the design of crane under notice this is completely obviated, as the jib can always be operated within a few feet of the position where the load is to be landed. In addition to being safer, this method is also much quicker. As the crane is fitted with travelling, slewing and luffing motions, the load can be placed in the exact position required, but with the derricks or aerial ropeways, as generally used, it is necessary to haul the loads into position, as they cannot be made to plumb exactly over the position where the load is to be landed.

Describing the crane generally it may be stated that the under carriage is of mild steel construction, fitted with suitable racepaths for carrying the column, and is 60 ft high; the column is of square section, built up of plates and angles, inside of which are fitted guides for carrying the counterbalance weight for the jib. On this square column are fitted the hoisting, slewing and luffing gears and motors, the travelling gear being fitted on the under carriage. The driver's cabin is also fitted on the column and is provided with the necessary controllers and lever gear for operating the crane in all its motions, either separately or simultaneously. The power required for luffing the crane is very small and is operated by means of an independent series motor and controller, fitted with automatic magnetic brakes.

The slewing is also operated by an independent motor and controller, operating through spur and bevel gear. The travelling is operated by an independent series motor and controller fitted on the carriage, driving through bevel and spur gear on to the travelling wheels; this motion is also fitted with powerful automatic magnetic brakes.

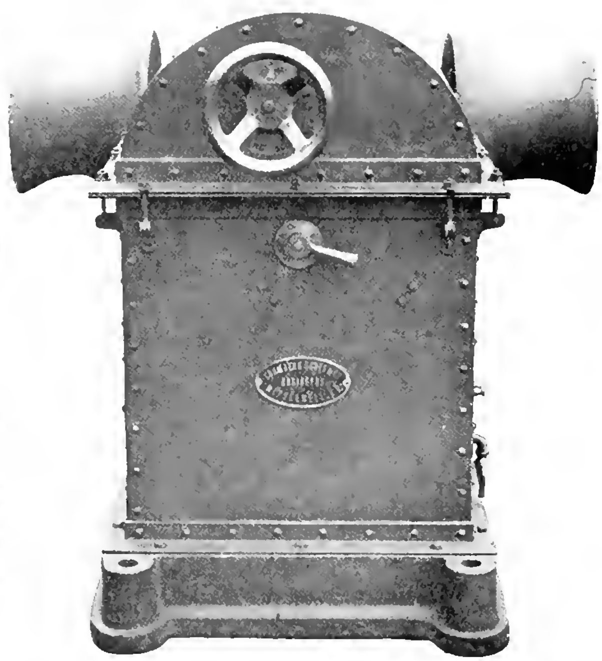
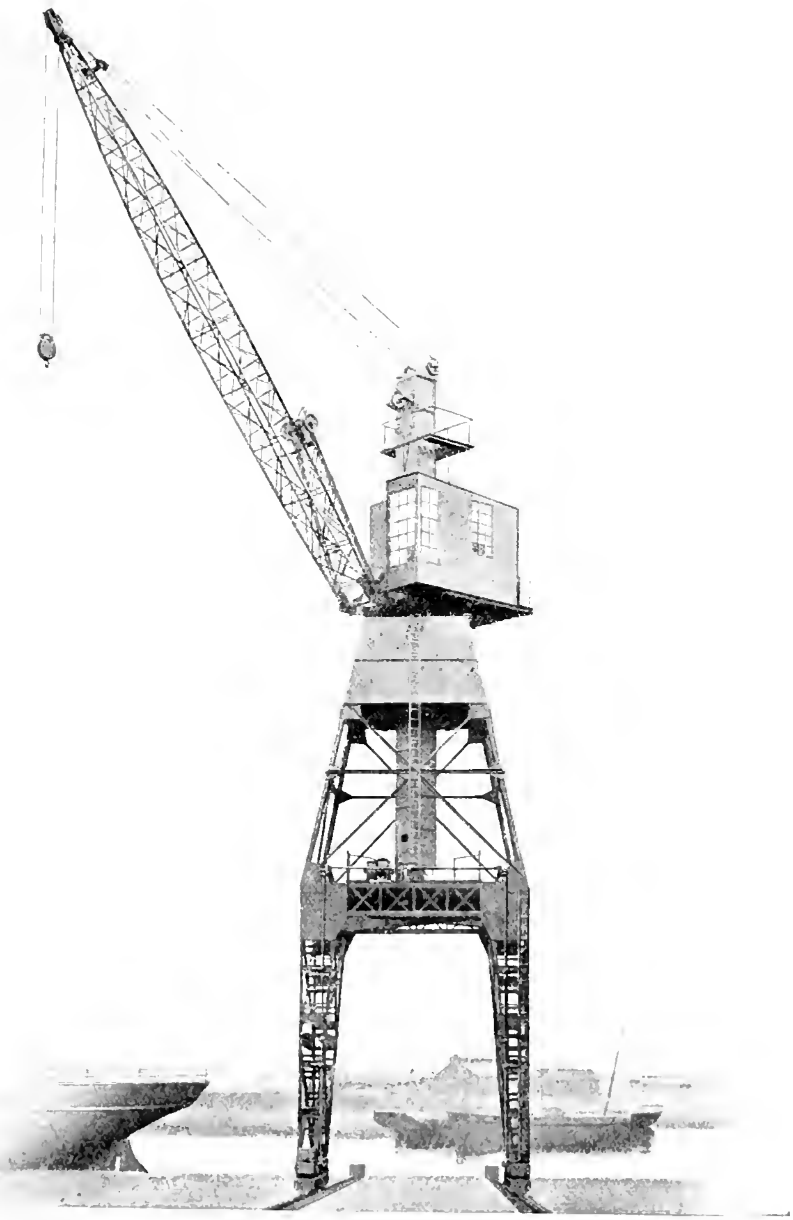


Fig 5.—Electric Shipyard Winch

The hoisting motion, which takes a good deal of power on account of the high speed, is operated by a compound motor, driving the Babcock & Wilcox patent Crypto gear, which provides the means of starting and stopping the load. The objects in using this gear instead of the motor and controller are:—(1) Its efficiency and its ability to start the load from rest without exceeding the full-load current by more than about 10 per cent. If a load is started by means of a motor and controller, the starting current exceeds the full-load current by 2 or $2\frac{1}{2}$ times. (2) Ease and safety of manipulation, the gear being of such a nature that the load can be instantly started or stopped, or operated at any speed, and in case it should foul anything the fuses will not blow or the gear get damaged, as the brake gear which performs the starting and stopping will slip. There is an automatic mechanical brake attached to this gear, which holds the load in any position until released by means of a foot lever.

In respect of crane facilities for the work of installing machinery on board ship after the vessel is afloat, there is a somewhat similar diversity of idea as to what is most efficient and worthy of adoption from the point of view of first cost. The well-known "sheers" or sheer-leg appliance for heavy lifts is now outclassed, or rendered almost obsolete, by later appliances; and that not alone by the steam or

hydraulic swinging derrick crane of a type very much in evidence on the quays of the dock authorities, but by the lofty, swinging, cantilever or "hammer-head" cranes which have been, within recent years, installed in many large engineering and ship-building works. The earlier and very native skill and long years of experience have enabled them to come forward with productions no whit behind the German importation in the matter of grace in design, and probably much superior in respect of working efficiency. The well-known firm of Sir Wm. Arrol & Co., Ltd., Dalmarnock, Glasgow,



5-ton Electric Travelling Jib Crane for Shipyard Work, by Messrs. Babcock & Wilcox, Ltd., Renfrew
Dimensions: 56 feet to top of carriage, jib, 60 feet radius
Height from rail level to centre of jib head sheave, 104 feet

powerful cranes of this type were supplied and fitted up by German firms; two of the earliest being at Messrs. Vickers, Sons & Maxim, Barrow in Furness, and at the naval works of Messrs. W. Beardmore & Co., Dalmuir, on the Clyde. British engineering firms, however, have within the last few years wakened up to the demand for such appliances, and their and of Messrs. Cowans, Sheldon & Co., Ltd., Carlisle have done, and are doing, notable work in this connection; and the next instalment of this series will be devoted to a consideration of mammoth appliances of this kind made by the firms named and others.

(To be continued.)

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

Portsmouth Dockyard.

THE battleship *St. Vincent* was commissioned as arranged on May 3rd for service in the Home Fleet and left a fortnight later to commence her duties. It is understood that the flag of Rear-Admiral Sturdee, second in command of the First Battle Squadron, will shortly be transferred to the *St. Vincent* from the *Lord Nelson*. The *St. Vincent* was twenty-eight months building and completing, and has cost just over a million and three-quarters. She is the seventh battleship of the "Dreadnought" type in the First Division of the Home Fleet. The battleship *Neptune* is proceeding apace and there is every reason to believe that she will be ready for her steam trials in the autumn. She is to be completed within two years of her being laid down, that is, by January of next year. The special service vessel *Seahorse* at the beginning of the month brought round from the Clyde the old gunboat *Rattler*, which is to be attached to the *Renown* for the training of stokers. The *Rattler* was the exercising ship of the Clyde Division of the Royal Naval Volunteers and was some time ago fitted with a new system of marine propulsion, that upon which Mr. McKechnie, of Messrs. Vickers, Sons & Maxim, read a paper before the Institute of Naval Architects about three years ago. The announcement that the contract for the construction of the new graving dock has been signed has given great satisfaction at Portsmouth. Messrs. Morrison and Mason, who have been given the contract, are building the new lock, which is to be side by side with the dock. The new dock is to cost a million and a half sterling, and it will be 1,000 feet long and 100 feet wide. Only about £300,000 is allowed for the work in this year's Estimates, so that if a similar amount is allowed annually it will be another four years before the work is completed. We had a visit on May 13th from Rear-Admiral Sir John Jellicoe, the Controller of the Navy, who conferred with the Admiral Superintendent and the heads of the various departments.

Devonport Dockyard.

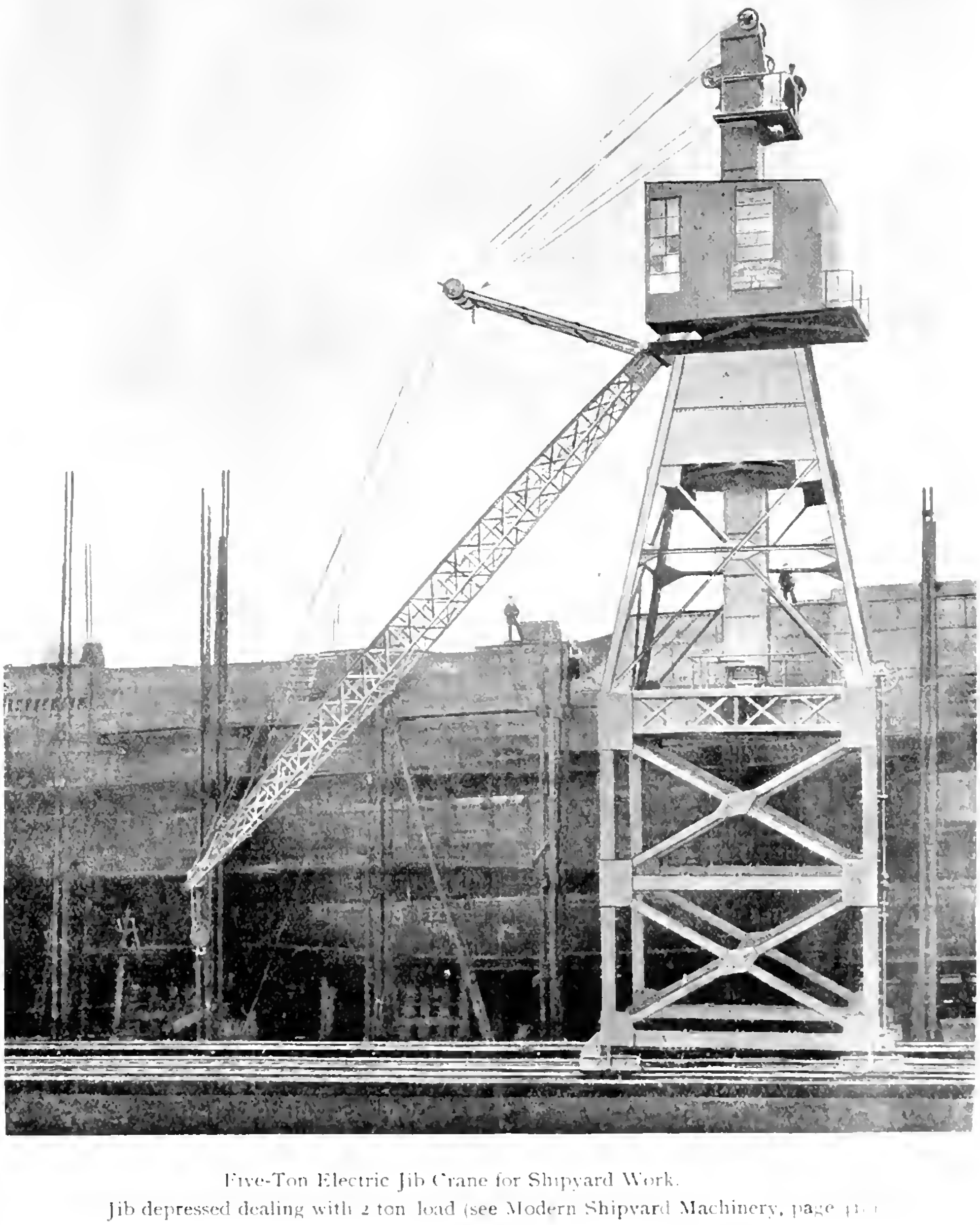
The battleship *Collingwood* left here on May 17th to commence her maiden commission in the First Battle Squadron of the Home Fleet, which now consists almost entirely of vessels of the "Dreadnought" class. The next vessel to be got out of hand will be the armoured cruiser *Indefatigable*, which, it is anticipated, will be completed in February, two years from the date she was laid down. Her destination will no doubt be the First Cruiser Squadron of the Home Fleet. Good progress is being made with the construction of the cruiser *Lion*, but it is not probable that she will be launched in August, as officially stated, as it is not anticipated that she will be ready until the following month. The work of preparing the cruiser *Niobe* for her new duties as a sea-going training ship for the Canadian Navy has been taken in hand. The estimate provides for an overhaul of the equipment and the replacement of defective fittings. The armament and torpedo fittings will be opened out, examined and brought up to date generally, and the boiler and engine-rooms will also be made thoroughly efficient. The work is to be completed by the first week in July, and almost immediately afterwards the vessel will proceed to the Dominion. It is interesting to note that a Canadian officer has been appointed to the command of the vessel. The officer is Commander Macdonald, the son of Senator Macdonald, of Victoria, British Columbia. Captain Macdonald recently served at Portsmouth as flag commander of the *Victory*, and he was also in command of the *Fire Queen*. He began his sea service in Canadian waters, having joined the *Royal Arthur* as a midshipman when that vessel was flagship of the British squadron at Esquimalt. The work in connection with the repairs and refit of the destroyers *Ostrich* and *Racehorse* is practically completed. The vessels when taken in hand were both disabled owing to their having been in collision in the Channel. The bows of the *Racehorse* were stove in, as was also the side plating of the *Ostrich*. While the vessels have been in dry dock their engine-room and boiler-room fixtures have been overhauled. The cruiser *Pelorus* is out of hand, and she was commissioned on May 17th for service in the Fourth Division of the Home Fleet at Portsmouth. The gunboat *Gossamer* has been taken to Haulbowline to be refitted. Her crew on returning here joined the sloop *Espiegle*, which is to be employed with submarines while the torpedo-gunboat *Hazard* is engaged on special duty. The *Forth*, the parent ship of the local submarine flotilla, will shortly be taken in hand for a refit. The work of preparing the torpedo-gunboat *Hebe* for her new duties as sea-going tender to a submarine flotilla has been completed, and she was commissioned on May 15th for service with Section VII. of submarines at Dundee. The principal appliances which have been added to the vessel's equipment consist of two powerful dynamo, with control fittings for connecting up to the submarines' accumulators, a double-action steam winch for dealing with an enemy's mines, and a set of high-power wireless appliances for keeping open communications over a radius of 400 miles. Excellent progress has been made with the work in connection with the conversion of the old wooden line-of-battleship *Ganges* from a hulk into an up-to-date establishment for boy artificers, and the vessel has been moved to her permanent moorings as part of the *Indus* group of mechanical training ships. The interior of the old vessel has been entirely remodelled, and all the available space has been fully utilized in connection with the berthing and housing of the ship's company. The dining-room, it may be mentioned, is over 90 feet long and is the width of the upper deck, and it will accommodate over 350 lads. The cruiser *Amphitrite* has been withdrawn from the local division of the Home Fleet and she is to be used for the training of second-class stokers in conjunction with the cruiser *Phaeton*. The *Amphitrite* will be used more particularly for the steaming instruction and the *Phaeton* for mechanical training.

Chatham Dockyard.

Many speculations have been made as to when our new cruiser will be laid down, but no intimation has yet been given as to the probable date. Seeing, however, that only a comparatively small sum is to be spent on her during the present financial year, and that we have plenty of repair work, it is not likely that she will be commenced until the early part of the winter. We are very busy just now with refits and repairs. The battleship *Dominion* will be out of hand on June 4th, and shortly after she will be recommissioned for further service in the Second Division of the Home Fleet. The battleship *Irresistible* has arrived and will remain here for several months. She will be paid off on June 1st, when she will be taken in hand for an extensive refit at a cost of over £80,000. The battleship *Agamemnon* has also come in to be overhauled. The scout *Adventure*, of the First Destroyer Flotilla, has arrived for a refit, and the scout *Patrol*, of the Nore Destroyer Flotilla, has also come in for docking. The cruiser *Sapphire* has completed her refit and has left to resume her duties with the Fifth Destroyer Flotilla at Devonport. The battleship *Magnificent* has also completed her refit. The vessels in hand include the cruisers *Antrim* and *Cressy*, in addition to the *Naiad* and *Intrepid*, the two latter being converted into mine layers. The cruiser *Acheron*, which is to be converted into a coal hulk for service at Sheerness, is in future to be known as Coal Depot 68. The special service vessel *Hearty*, which has been temporarily fitted for surveying work, has gone to Dover, which she will make her head-quarters while carrying out a series of deep sea tidal observations in the English Channel. On the conclusion of that work she will commence her first season's surveying duty in the North Sea, off the Scottish coast. Captain Munro, the late assistant hydrographer of the Navy, is in command of the *Hearty*. Another of our submarines, *C 33*, has been launched. Usually there has been a short ceremony, but on account of the King's death the proceedings were of a formal character, and were only attended by the principal officers of the port and yard. The vessel was afterwards taken into No. 2 dock to be completed, and as she is in a very advanced stage it will not be long before she is ready for her trials. On May 9th Rear-Admiral Sir John Jellicoe, the Controller of the Navy, paid us an official visit in connection with the work of the yard.

Sheerness Dockyard.

Our new member of Parliament, Mr. Wheeler, has been asking for information as to the site arranged for the proposed floating dock for the Medway and the yard from which it is to be worked, but the only information he could obtain from Mr. McKenna was that the question as to the working of the dock was being considered in connection with the site. We, of course, are anxious to know, as the position selected will determine whether the dock is to be worked from this yard or from Chatham. The extensive dredging operations at Sheerness Bar have been completed and the surveying vessel *Triton* is to make a new survey of the bar and the Medway Channel. The ocean-going destroyer *Afridi*, which has had her under-water fittings examined and her keel coated with preservative compound, has left to rejoin the First Destroyer Flotilla, and the *Saracen*, *Usk*, *Garry*, *Amazon* and *Teviot*, of the same flotilla, have also completed their refits. There are still five vessels of the flotilla in hand, the *Boyne*, *Tartar*, *Wear*, *Ness* and *Nith*. The two last-named vessels came on here after escorting the late King from Calais to Dover. The *Cherwell* is also in hand. She has ceased to be attached to the First Flotilla, and on the completion of her refit will join the Second Flotilla. Submarines C 1, C 3, and C 4 have been taken in hand for their annual refits. Submarines C 2 and C 5 have rejoined the flotilla at Harwich, but C 6 will remain a short time longer in the steam basin for an examination of her electric batteries. It is interesting to note that Torpedo-boat No. 070, which was the first vessel commanded by King George V when a lieutenant, is attached to the flotilla in Stangate



Five-Ton Electric Jib Crane for Shipyard Work.
Jib depressed dealing with 2 ton load (see Modern Shipyard Machinery, page [illegible])

Creek. His Majesty was in command of No. 79, as the vessel was then designated, when he went to the assistance of a torpedo-boat which had broken down at Lough Swilly during the manœuvres of 1889. The disabled boat was hauled into a safe anchorage, and the "senior officer present" has referred to the incident in a letter just published as a "smart piece of seamanship which would have done credit to an officer who had had a far wider experience of this sort of work than Prince George had then enjoyed." On May 10th we received an official visit from Rear-Admiral Sir John Jellicoe, the Controller of the Navy, who made a tour of the yard and went on board some of the vessels of the First Destroyer Flotilla undergoing refits. The Controller was for some time in consultation with Captain Torlesse, the captain superintendent. That officer, it may be here mentioned, has just been awarded a good service pension of £150 a year.

Pembroke Dockyard.

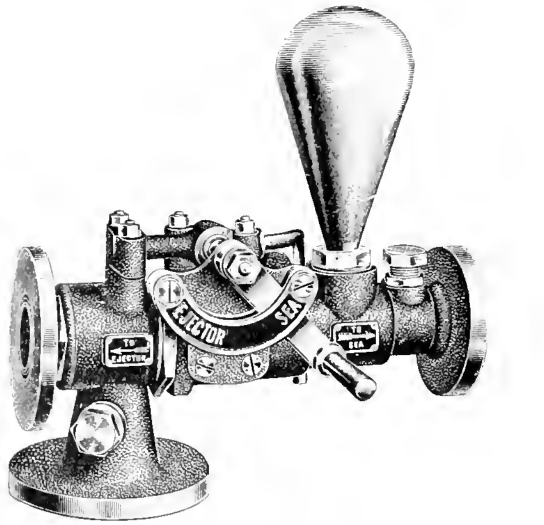
The external plating of the *Blonde* is all in place, having been expedited so as to permit of the engineers commencing boring operations for the propeller shafting during the third week in May. The date of the launch has not yet been announced, but judging from the work to be done it will be about the end of June, as stated last month. The six turbines of the *Blanche* have been delivered and are all in place, and efforts are being made to get them secured and otherwise completed as quickly as possible. The number of workmen has been increased, and day and night shifts have been resorted to so as to get the vessel ready for her trials by July 18th. A quantity of plates for the first of the two new cruisers has been delivered. The new ship will be put in hand immediately after the launch of the *Blonde*. Both the new vessels will be replicas of the *Blonde* as regards their external form, excepting at the bow, which is to be similar to that of the scout *Attentive*. This means that the ram formation, which is a characteristic feature of the vessels of the *Boadicea* class, is to be dispensed with. As regards the portion of the ships to be occupied by the machinery spaces, they will be absolutely identical. A change in form of the new vessels may be rendered necessary by a reversion to the practice of quartering the officers aft instead of forward, as was done in the case of the *Boadicea* and *Bellona*, and is proposed to be followed in the *Blanche* and *Blonde*. The quartering of the officers aft will be the main consideration to be taken into account in determining whether the ships will have to be lengthened forward, as compared with the ships of the class now in hand. The torpedo-boat destroyer *Sylvia*, having had her propeller shafts withdrawn and overhauled, her underwater fittings examined and repaired, and her outer plating cleared and coated, has been completed. She was taken in hand after the completion of the *Osprey* in December. Another destroyer, the *Avon*, has come round from Devonport for a refit and her crew have been turned over to the *Sylvia* to take that vessel back to port. The torpedo-gunboat *Antelope* and torpedo-boat No. 033 are still in dockyard hands.

ANON. DES FORGES ET CHANTIERS DE LA MEDITERRANEE.—It is stated that the yard at Marseilles will be closed shortly and all work concentrated at La Seyne, near Toulon.

THE INSTITUTION OF MECHANICAL ENGINEERS AND THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. JOINT SUMMER MEETING, 1910. A Joint Meeting of the American Society of Mechanical Engineers with the Institution of Mechanical Engineers will form the summer meeting this year. The meeting will be held in Birmingham and London, and will begin on Monday, 25th July. A Local Committee, consisting of the Right Hon. the Lord Mayor of Birmingham, Alderman W. H. Bowater, together with members of the Institution and other gentlemen resident in the neighbourhood, has been formed to make the necessary arrangements. A Ladies' Committee will be formed in Birmingham to make arrangements for the entertainment of ladies accompanying the members of both Societies. The proceedings will open in Birmingham and will be continued in London on the 28th July.

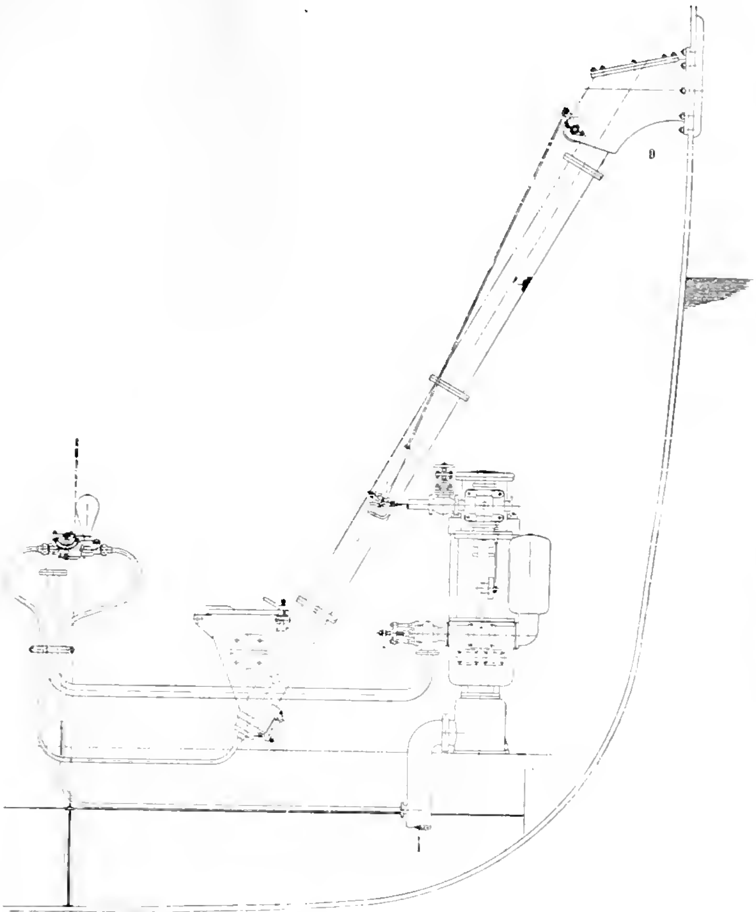
AN AUTOMATIC ASH EJECTOR.

THE tedious process of clearing ashes out of the stokehold by means of buckets hove up the ventilator, then tipped into a hopper and shot down a tube having its outlet at about the water level, under the encouragement of a jet of water by the force of gravity, has many disadvantages. Even greater disadvantages has the process when, in place of being shot down a tube, the ashes are thrown overboard from the working deck, sometimes with, sometimes without a downcast to prevent them finding a lodgment on board again as unwelcome visitants to the living quarters or to the eyes of the voyager. The outlet at the water line has proved a fruitful cause of trouble in some cases by leading to wastage of the ship's plates, due to the friction of the discharged ashes, while the tube itself requires patching and

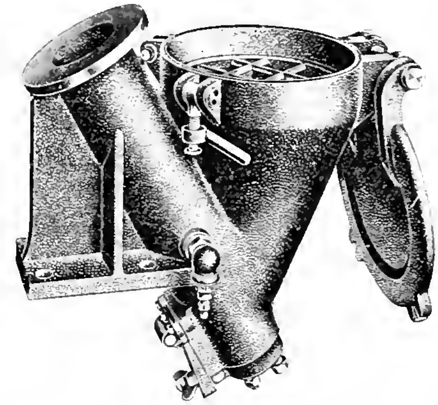


Patent Differential Starting Valve.

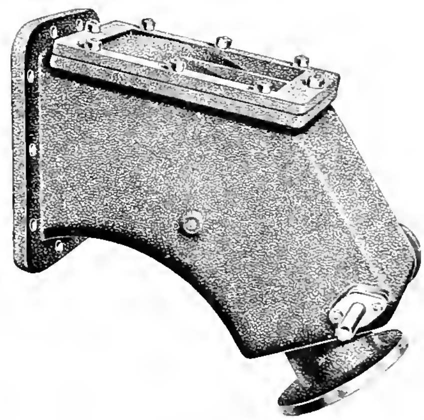
renewal from time to time during the life of a ship. The labour involved in getting rid of the ashes by heaving up is also heavy and grievous. Recent years have seen the adoption of the ejector method of discharging the ashes through the bottom or the sides of the ship with considerable energy and sufficient water to carry them clear and prevent in the one case damage to the hull plating, and in the other inconvenience to those on board by any returning debris. The well-known firm of Messrs. Schäffer & Budenberg, Manchester, has introduced an automatic ash ejector, the arrangement of which is illustrated to show the general design to meet ordinary cases, but which can be modified to suit special requirements. The ashes from the firing platform are thrown into the hopper, a jet of water from a pump under a pressure of about 100 lbs. is admitted, and the ashes are carried up the pipe and through a valve chest on the ship's side and expelled with ample force to carry them quite clear of the ship. The water is admitted to the hopper and regulated by means of a starting valve, which is easy of manipulation, and is one of the special features of this ejector. There are three standard sizes made—4-in., 5-in. and 6-in. The chief points worthy of careful observation in connection with



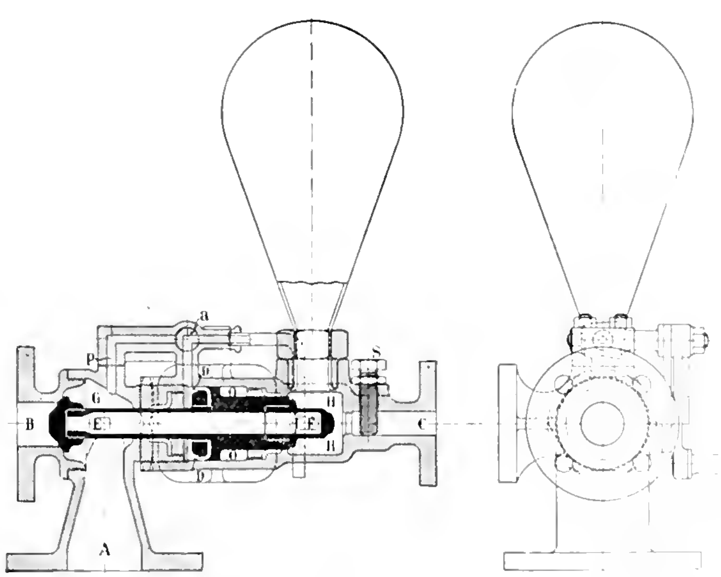
General Arrangement of Automatic Ash Ejector on Steamers.



Hopper with Inserted Grating (Cover open).



Discharge Box for bolting to side of Ship.



Illustrations of Messrs. Schaffer & Budenberg's Automatic Ash Ejector

the design of this ejector include the automatic valve for regulating and controlling the water supply. In order to get the best results from such a device as the ash ejector the water from the pump to the hopper should be opened sharply to eject the ashes, and to overcome the difficulty sometimes experienced in so opening a large cock, and at the same time lessen the mechanical labour necessarily involved, the valve in question is fitted to be ready of access and easy of manipulation, a quarter turn only on the lever being sufficient to open or close the connection. The whole apparatus can be readily adapted to any steamer. The output of ashes from twenty-four tons of coal can be discharged from the stokehold to the sea in from sixteen to twenty-four minutes, according to the class of coal being consumed. There is no doubt as to the great advantage this style of ejector has over the older methods, and it contains within it improvements which commend it for modern practice as a labour-saving appliance, in addition to its other advantages, and we have pleasure in giving illustrations of the details.

THE ADOPTION OF ELECTRIC PROPULSION OF WARSHIPS FROM A MARINE ENGINEER'S POINT OF VIEW.

THOSE who were fortunate enough to be present at the recent spring meetings of the Institution of Naval Architects must have gathered a great deal of information from Mr. W. P. Durtnall's remarks upon electric propulsion. In "Engineering" of May 6th his high ideals in this matter are emphasized in his answer to a recent leading article upon this subject.

He states: If economy in fuel, and therefore extra steaming radius, lighter draught and higher speed, be required, together with powerful manœuvring on warships, electricity must be used between the modern high-speed prime movers and slow-speed large-area blade propellers. He cites an anticipated ship by Mr. Emmett, of America, of 28,000 i.h.p., 240 revolutions for propellers (twin) and 1,300 revolutions for turbines, and he calculates for equal consumptions a Parsons turbine equipment would give 20·5 knots, which would be increased to 21·2 knots with an electrical drive, also that the bunker capacities would be

Parsons, 2,480 tons,
Electric drive, 2,700 tons,

giving at 12 knots cruising speed a radius of action of 4,700 and 7,900 knots respectively, an increase of 69 per cent.

He furthermore claims to have satisfied many practical naval engineers that the electrically-driven and auxiliary-engined warship is inevitable. This comparison is hardly fair, for in the case of, say, a battleship the "cruising" speed (for which the maximum economy is designed) is about 18½ knots, the full speed being 21 knots. In a warship there are many considerations involved before making such a radical departure from what are at present not fully-developed lines, and there is no reason why, with our increasing knowledge of propeller design and performances, we should not use a higher speed of revolution than 240 per minute, say up to 350. For obvious reasons the length of a naval engine-room must be brought down as much as possible. It is also obvious that a faster-running turbine will be of smaller diameter than the slower-running one, *but* the positions of the turbines are largely fixed by the positions of the propellers, and in a two-shaft arrangement, such as Mr. Durtnall appears to favour, the propellers would be approximately eighteen feet in diameter (for a battleship), consequently the breadth of the engine-room would not be greatly reduced. Any saving in length of the turbine is not quite apparent, as the bearings and glands occupy about three-quarters of the length of the rotor (about 12 feet for a 6,000 h.p. engine). Moreover, a specially heavy thrust block would have to be fitted to take the propeller thrust, in addition to the turbine-adjusting block, thus reducing the probability of any reduction in length.

Such a system would entail the introduction of a generator capable of providing sufficient power to drive a motor in its turn capable of producing 13,500 s.h.p. for a battleship or 35,000 for a cruiser (or 6,750 and 17,500 respectively for a four-shaft arrangement), meaning that *five* transmissions of power take place from the fuel before it appears at the propeller. It is open to question whether the losses attendant on these extra transmissions, together with the working friction losses in the extra number of high-speed bearings, would more than counterbalance the increase in efficiency due to the adoption of high-speed turbines.

A great point is made of the elimination of the astern difficulty and of the availability of the whole power for so moving. It must be remembered, however, that full power is not wanted for going astern, and could not be used if it were, as the ship would be quite unmanageable. It appears as though the small astern turbines would be eliminated by the addition of at least *one* full-power unit to the "ahead" system.

An important point in a warship is connected with the *personnel*. The electrical equipment is under the charge of the torpedo branch as distinct from the engineers, and the result of having two "heads of departments" in one engine-room may better be imagined than described.

Mr. Durtnall also advises a system of electrically-driven auxiliary machinery. The experience so far has been that, with the exception of the electric-light engines, general satisfaction has so far not been obtained. The result of a large inrush of water causing a short circuit in the ship at a high voltage would certainly be dangerous.

In conclusion, it may be said that the general opinion amongst the engineers in the navy (and of those outside) is that a warship's fittings should, before everything, be reliable and as simple as possible, and the addition of complications which might result in a possible increase of 1 or 2 per cent. in efficiency at the expense of simplicity is not viewed with great favour; indeed, the general wish seems to be to keep electrical gear down to a minimum.

BRAZILIAN BATTLESHIP TRIALS.—The Brazilian battleship *Sao Paulo*, built by Messrs. Vickers, Sons & Maxim, Barrow, which arrived in the Clyde on May 17th to undergo speed trials, was subjected to an exhaustive series of tests over the measured mile and on longer stretches, including a forty-eight hours' steaming trial and a twenty-four hours' full power test on the Firth of Clyde, from the 20th to the 26th May, with satisfactory results. This powerful vessel whilst in dry dock at Liverpool before entering upon her trials on the Clyde, had her hull coated with Hartman's Rahtjan's Red Hand Brand Composition.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Salvage of the "Minnehaha"

is one of the finest pieces of work of its kind ever effected, and it is one for which the Liverpool Salvage Association and Captain Young, their executive officer, deserve unstinted praise. When the big liner took the rocks at Scilly no one could have entertained much hope that she would ever be got off, and indeed the rates quoted for re-insurance showed that the underwriters, naturally enough, took anything but a sanguine view of the case. There seemed every probability that the vessel would turn over and slip off the rock in which case she would undoubtedly have gone down in water so deep that salvage operations would assuredly have been out of the question. Badly injured as she was forward, she lay exposed to the swell of the Atlantic, which made work upon her difficult indeed, both for those upon whom the work of discharge fell and also for those who were engaged in preparing her hull for the attempt to float her. Yet at the same time the circumstances made it essential that no effort should be spared in the attempt to get her into a more sheltered position. The injuries she had sustained must have been serious enough, for the steel decks were forced into irregular shapes, and no less than three of her bulkheads were started, whilst some of the stanchions in the lower hold had been forced upward through the deck above them. Covers had to be made to the hatches of five holds and the decks platformed so as to stand the strains which were to be put upon them. Much of the work had, of course, to be done by divers, and bad weather interfered with their operations towards the last. On the 5th May it was reported that the ship was sustaining further damage through the heavy weather, and on the 9th it was announced that the unfavourable conditions then prevailing would probably make it impossible to attempt to float the ship till the following spring tides. But a favourable opportunity did present itself, and without hesitation the chance was taken. The vessel came off, and her engines being uninjured, she was able to steam into shelter in Crow Sound. There further repairs were executed and she was convoyed to Falmouth, the water being easily controlled by the pumps. The salvage was carried out by the aid of no less than seventeen pumps and three air compressors. Falmouth, unfortunately for itself, possesses no dry dock long enough for a 600 ft. ship such as is the *Minnehaha*, and the big job of repairing her will go elsewhere.

New Steamships.

Several important companies are about to make further additions to their fleets. The sixth 12,000 ton twin-screw of the Orient line has now been definitely placed with Messrs. John Brown & Co., of Clydebank, who built the *Orsova* one of the five sisters which were prepared to take up the new mail contract. The Cunard Company has given an order to Messrs. Swan, Hunter & Wigham Richardson Ltd., for a sister to the *Franconia*, now under construction. These two ships will, it is stated, go into the Liverpool and Boston service, whence the smaller of their steamers now on that route will be diverted to the Mediterranean. Some time ago—about the time when the Canadian Pacific Railway produced the *Empress of Britain* and the *Empress of Ireland*—the Allan line spoke of its determination to add two other turbine-engined vessels to its Liverpool and Quebec Mail service. But an arrangement as to sailing dates with their rivals followed, and no step was taken towards the materialization of their scheme. But now—partly perhaps because of the development of Canada herself and partly perhaps because of the advent of the fine ships of the Royal Line to Bristol—they have determined to build two 20,000 ton liners. These ships are to be of about 22 knots speed and to be driven by turbine engines, for the Allan line has had every reason to be satisfied with that type of engine, which has done them such good service in their steamers *Virginian* and *Victorian*. Speaking of their *Virginian* impels me to make a digression which will perhaps be pardoned under the circumstances. Two *Virginians* have for some years hailed from the port of Liverpool, and the fact has been apt to cause confusion, though indeed the two ships have been of very different character, even if they have both been engaged in the North Atlantic trade, the one a triple-screw mail and passenger steamer plying to the St. Lawrence, whilst the other was an older craft belonging to the Leyland limb of Mr. Morgan's combine and generally engaged in the Boston cargo trade. Opportunity for confusion is now passed, for the Leyland *Virginian* has been sold to Italian shipbreakers and left the Mersey for the last time on the 3rd May *en route* for Genoa, where she is to be broken up. She was an iron steamer built in 1881 by Messrs. Palmer, of Newcastle. She had only compound engines, though her boilers were renewed in 1898. Her gross tonnage was about 4,200 tons. To return—their 22 knots speed will give the two new Allan liners the heels of all ships plying to the St. Lawrence, including the two Royal liners, and will, indeed, put them well up in the speed competition even by the standard of New York flyers.

The Union Castle Line having during the month of May seen the *Edinburgh Castle*, second of its two new Mail steamers start on her maiden trip, at once set about further adding to its fleet. Three new steamers are to be built. But it is not necessary to construct more mail liners, since there are now enough first-class vessels to insure the readiness of a twin-screw vessel for despatch every Saturday and to keep one such vessel as a stand by. The new ships are to be of the intermediate type and are to be sisters of the *Garth Castle* and *Grantully Castle*, which have recently been added to the fleet. The orders for these three new ships have been placed, as to one vessel each, with Messrs. Harland and Wolff, Messrs. Barclay, Curle & Co., and the Fairfield Shipbuilding Co.

The Aberdeen Line

are, it is said, likely to change the name of the vessel now building at Queen's Island from *Themistocles*, as originally announced, to *Euripides*, on the ground that the latter name will be more easily dealt with by seamen and others. This Company has sold its *Damascus*, built in 1887 at Glasgow by Messrs. Robert Napier & Sons, to Italian shipbreakers. As regards the loss of the *Pericles* it is now reported that the fatal uncharted rock has been discovered. Its summit is no less than twenty-four feet below the surface, and thus in smooth weather it would be possible for vessels of considerable size to pass over it without any suspicion of the existence of such a hidden danger.

The Imperial Direct Line

sent in the only tender for the renewal of the Banana subsidy, which is to commence on the expiration of the present contract—which the Company itself holds—on the 15th January, 1911. The sum asked by the Company for the proposed service is £40,000 per annum, as before. It does not propose to give the increase of a knot in the speed of the vessels which the advertisement calling for tenders suggested, but it does provide for a call at Bermuda, both on the outward and homeward voyages, and it also undertakes that the carriage of citrus fruit shall be encouraged.

It is now stated that this single tender will not be accepted in its present form and that either the £40,000 will be refused and various made up sums offered in its place, or possibly arrangements with the Royal Mail Company may be made.

The Great Eastern Railway.

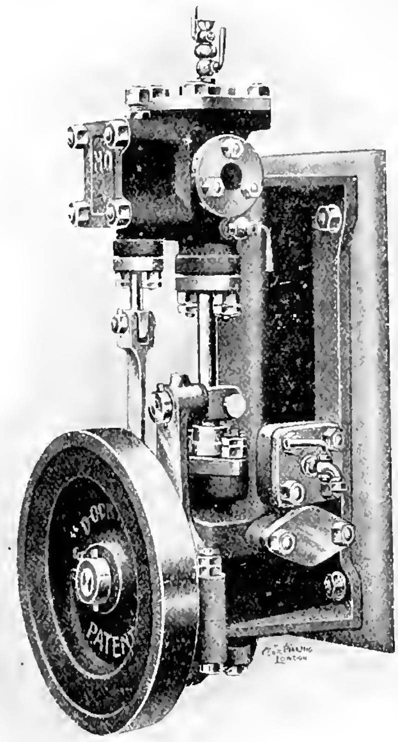
On the last day of April a party of invited guests went down from Liverpool Street to Harwich in a new corridor train which this Company has recently provided for its Antwerp service. The coaches throughout the train are most luxurious, and ran with conspicuous smoothness even over the numerous junctions in the outskirts of London. The journey occupied exactly an hour and a half in each direction and was in fact just long enough to give one opportunity to admire the comfort of the dining saloons and the completeness of the kitchens and pantries. On arrival at Harwich the party embarked on the Company's twin-screw liner *Vienna* and went out to sea for a cruise of a couple of hours thereby giving time for an exposition of the convenience and advantages of the wireless installation and of the submarine bell receivers with which the vessel, like others of the fleet is now fitted. As

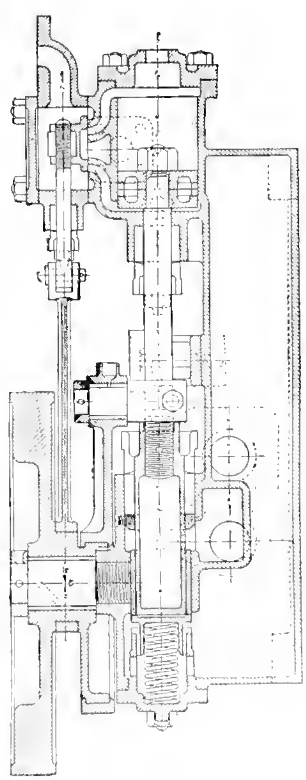
the Corporation of Trinity House is now providing a submarine bell on the Sunk Lightship, the advantage of the receivers will in the future be even greater than at present. A new steamer, the *St. Petersburg*, fitted with turbine engines by Messrs. John Brown & Co., of Clydebank, was launched on the 25th April. She is a sister to the *Munich* and the *Copenhagen* already at work, and the Company will thus be enabled to provide an entire service of turbine-engined steamships on the Harwich route to the Hook of Holland.

The Royal Line
has inaugurated its service to Canada by the departure of its steamship *Royal Edward* from Bristol on the 12th May. The occasion was noticeable for several reasons. Amongst them from the fact that the two special trains which brought down the London passengers were the first to run over the new line between Filton and Avonmouth. They were thus enabled to avoid the City of Bristol altogether, and thus in fact to cover the 120 miles of their run from Paddington to the ship's side in about twelve minutes over the two hours. On this, her first voyage, the *Royal Edward* is said to have taken out some 750 passengers all told. It may be that the Bristol route was not sufficiently advertised amongst the travelling public. But whatever the cause, when one considers the immense volume of passenger traffic now setting to the westward and regards the numbers borne in each of the liners which sail from Liverpool to the westward, one can hardly consider this a very promising beginning. Some complaints have been made in the press as to carelessness on the part of the Dock authorities at Avonmouth in failing to provide proper fenders for the protection of the *Royal Edward's* hull as she passed out of the lock, whereby her sides were scraped by the stonework and showers of sparks flew from her rivet heads. Whether the story be an exaggeration or not I do not know. But if it be all true, one can pardon a little from those who for the first time were handling a vessel of this class. As might have been expected from the vessel, which attained such a reputation for speed as did this vessel under her old name of *Cairo*, the *Royal Edward* made a fast passage across the Atlantic, averaging 19½ knots in the open sea—a speed which of course gives her the record to Canadian ports. The second steamer of the Company—the *Royal George*, formerly the *Heliopolis*, was appointed to sail on the 26th May, thus providing a fortnightly service. The sailing date of the third vessel—formerly the Italian liner *Volturo* and now the *Royal Sovereign* has not yet, so far as I know, been announced.

The Report of the White Star Line
for the year 1909 shows a great improvement over that for the preceding twelve months. The item of "general interest" has fallen from £69,000 to £34,000, whilst that of debenture interest has risen from under £5,000 to over £56,000. Depreciation has risen from £357,000 to over £410,000. Profit was just under £300,000 in 1908. In 1909 it had more than doubled, being over £614,000. A sum of £150,000 is distributed for the year on the share capital of three-quarters of a million sterling. This is, of course, a thoroughly satisfactory distribution and one made, it will be observed, after an increased provision has been set aside for the depreciation of the fleet and other properties of the Company. The charges in the items for interest are due to the funding of the debt.

The Use of Wireless Telegraphy at Sea
is constantly extending. In the North-Atlantic the Companies which have installed it in their more important vessels are having it added to their older ships, and its value is constantly being proved. Thus in the case of the recently fitted *Carthaginian* of the Allan Line much time and possibly a heavy salvage award were avoided. Shortly after sailing as an extra steamer for St. John's and Philadelphia at the end of April, the *Carthaginian* had a breakdown in her engine-room through the failure of a piston-rod. She sent off wireless messages for assistance, and got in touch with the Company's *Hesperian*, then on her eastward voyage, and so brought her to the rescue. Some 250 miles West of Malin Head she found the disabled steamer, took her in tow and brought her into the Clyde, where repairs were effected, and on the morning of the 30th April the *Carthaginian* resumed her voyage—just a week after her original sailing from the Mersey.





The Dockhead Donkey Feed Pump.
For description see opposite page.

THE DOCKHEAD DONKEY FEED PUMP.

THE illustrations of this pump shows at once a neat and simple piece of mechanism which will commend it to those who are about to consider what the market has to offer in donkey pumps, of which the type before us will satisfy the requirements. This style is made either single or double acting. The cylinder, air vessel and pump chamber are all in cast iron of one piece, the latter being lined with gun metal. The flywheel and eccentrics are also cast in one; the ram, glands, valves, seatings and fittings are gun metal, and for convenience in placing and meeting the pipe-lines, the exhaust, suction and delivery branches are on both sides of the pump. There is one eccentric for working the slide valve and another which serves as a crank connected to the piston rod by means of a crosshead pin and eccentric rod.

MOTOR CONGRESS.—A Scandinavian Fishery Motor Congress will be held on June 23rd, 24th and 25th. The programme includes the following subjects:—Motor fuel; The importance of the motor for the development of the fishing industries; Different motor types; Conditions for the use of wireless telegraphy and telephone in the fishing industry, etc.

SUBMARINE SIGNAL COMPANY have now under construction for Trinity House four sets of submarine pneumatic bells. The Company is instructed by Trinity House that these bells, which will probably commence working early in June, are intended for the following light-vessels:—Cross Sand, off Yarmouth; Sunk, off Harwich; Breaksea, in the Bristol Channel; Morecambe Bay, off Fleetwood.

"PRINCESS ROYAL."—The keel of the battleship-cruiser *Princess Royal* was recently laid at the Naval Construction Works of Messrs. Vickers, Sons and Maxim, Ltd., Barrow. She will be 700 feet in length, or about 200 feet longer than the British battleship *Vanguard* which has just been commissioned. Her displacement will be 26,000 tons, and she will be completed within two years from the date of laying the keel. This will be by far the largest warship ever turned out by any firm for the British or any other navy.

THE SOCIETY OF ENGINEERS (INCORPORATED). Society of Engineers, established May, 1854; Civil & Mechanical Engineers' Society, founded May, 1859.—The paper to be read on June 6th is entitled "The Inspection and Testing of Engineering Materials and Machinery," by C. V. Biggs, A.I.E.E. (Member), the following being a synopsis:—Objects of testing—Necessity of testing—Present risks of breakdown—Tests for structural steel-work—Boilers—Valves—Economisers—Piping—Condensers—Steam-Engines. Interim inspection of parts—Final test—Generators and Motors—Accumulators—Cables—Bare copper—Tramway fittings—Switch-boards and Switch-gear—Porcelain Insulators—Meters—Machine tools—Cranes.

INSTITUTE OF METALS.—A PATHOLOGICAL MUSEUM FOR METALS AND ALLOYS.—The Council of the Institute have pleasure in announcing that there has been established at the offices of the Institute a Pathological Museum for specimens of metals and alloys, the first contributions to the Museum having been received from the President, Sir Gerard A. Muntz, Bart. This Museum, which is the only one of its kind, ought to be of great service to all interested in the metallurgy of the non-ferrous metals, as it is intended that it shall contain specimens showing the various ways in which such metals as copper, brass, aluminium, etc., can fail, either as a result of faulty manufacture or of improper usage. The Council has accepted an invitation from the Glasgow Members of the Institute to hold the Annual Autumn Meeting in Glasgow. The meeting will take place on September 21st and 22nd, on which days papers of scientific and practical interest will be read and visits made to works of metallurgical interest.

THE NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

Inauguration of New Rooms.

Presentation to Mr. William Boyd (First President).

THE inauguration of the new rooms of the North-East Coast Institution of Engineers and Shipbuilders in the Bolbec Hall, Newcastle-on-Tyne, and the presentation of a marble bust to Mr. William Boyd, took place on Monday, the 23rd May. The President, Mr. Summers Hunter, occupied the chair, and was supported by Mr. William Boyd, the Right Honourable Lord Armstrong, M.A., D.C.L., Sir Andrew Noble, Bart., K.C.B., Sir Benjamin C. Browne, D.C.L., Sir Theodore Doxford, J.P., Mr. W. H. Dugdale, Colonel R. Saxton White, V.D. (President-elect), Dr. G. B. Hunter, Professor R. L. Weighton (Armstrong College), Professor J. J. Welch (Armstrong College), Principal Hadow (Armstrong College), Mr. W. G. Spence and Mr. C. W. Hutchinson (two of the founders of the Institution), Mr. Norman Burnett, Mr. Alfred Harrison, Alderman S. T. Harrison, Alderman Matthew Murray, Mr. D. Myles, Mr. G. D. Weir, Mr. C. S. Hunting, Mr. Hartley B. N. Mothersole, Mr. M. C. James, Archdeacon Henderson, Mr. R. H. Winstanley (Hon. Treasurer), Mr. John Duckitt (Secretary) and many others.

The President, in opening the proceedings, said:—Ladies and gentlemen:—We are gathered together to-day under a combination of most exceptional circumstances, and, to a great extent our proceedings are darkened by the shadow of a national, a world-wide loss. Within the last few days this national grief has been somewhat assuaged and in other ways relieved by the gracious messages of H.M. King George indicating that, after a time, his subjects should pursue their usual avocations, encouraged and strengthened by the example of a good and a great King who has passed to his rest.

The Special Committee charged with the conduct of our proceedings took advice and conferred together, and after Friday, the 20th, was fixed for a ceremony that will live in the memory of all present, we felt that, as part of our business, the original arrangements for to-day—modified in character—should be carried out. As their first duty, the Council of this Institution, in meeting assembled, gave expression (through the medium of a suitable address) to our feelings of sorrow, and assured H.M. the King and the Royal Family of our sincere sympathy and devotion.

Our meetings to-day, therefore, are primarily, by the inauguration of these rooms, to complete a work that has been in progress for fully five years, to recognise Mr. Boyd's work for the Institution, and after that to hold the last general meeting of the session. Before calling upon Mr. Boyd, I would state briefly what has led up to this gathering to-day. Some five or six years ago it was recognised by the members that this Institution required better and more suitable accommodation, to enable it to carry out the work for which it was founded. About the same time the engineering and shipbuilding employers required new offices, and the idea of what ought to be a home for our leading industries took root and grew. Eventually, a joint committee was formed, practically representing no less than nine or ten shipbuilding and engineering Employers' Associations, and included the Employers' Insurance Association, the Foremen's Mutual Benefit Association, and this Institution. Mr. Boyd was elected chairman of this joint committee. The negotiations were many and protracted, and they culminated in the Literary and Philosophical Society, of Newcastle, building this Bolbec Hall, five floors of which are held on lease by the Tyne Engineers' and Shipbuilders' Associations, this third floor being held by the North East Coast Institution, as sub-tenant. The room in which we are now assembled is the library. It is now my privilege to ask Mr. Boyd to honour the Institution he helped to found, and of which he was the first president twenty-six years ago, by formally inaugurating these rooms.

Mr. William Boyd, in declaring the rooms open, said: It is a matter of very great pleasure to me to be called upon

this afternoon to declare these new rooms open for the members of this Institution, and, in accordance with this request, I hereby declare them open for that purpose. You will pardon me if I ask your attention for a few minutes to some remarks on some of the salient points in connection with the Institution, and to explain some of the events which have led to the occupation of these rooms in which you now find yourselves housed. The President has told you the story of how the joint occupation of Bolbec Hall came about, and I need not repeat it, beyond saying that many of us thought it was of great importance that advantage should be taken of these circumstances, and that in any new quarters the employers' offices and the rooms of this Institution should be under one roof. It was felt that this could be accomplished to the mutual benefit of all concerned, and would help the heads of our various shipbuilding and engineering establishments to realize that this Institution was not merely a school for academic discussion and technical talk, but was a vital, living society, and as such, played no ignoble or insignificant part in the conduct of the two professions of shipbuilding and engineering, and was, therefore, deserving of their sympathetic support in every possible way. After much consideration and effort, into which I need not enter, Bolbec Hall is the result, and I can only trust that the hopes and anticipations which we held some years ago will be fully realized as years go on. Of the advantage which will be derived by the employers generally, it is not my place to speak here, but I do most earnestly hope that the members of this Institution will one and all see to it that full advantage is taken of the increased opportunities which these rooms offer; otherwise, our labours will have been very much thrown away. The passing of the years has greatly thinned the ranks of those who were amongst the first presidents of the Institution. There are at present 1200 members of all classes, as compared with 452 in 1884-85. These 452 members comprised 375 ordinary members, thirty-eight associates and thirty-nine graduates. Out of thirty-nine graduates, seven remain on the roll as ordinary members, and out of 413 members and associates there are only eighty-five left on the books. Out of the vice-presidents and Council (twenty-four in number) only seven remain, excluding myself, *viz.*, our old friend Mr. C. W. Hutchinson, who was a tower of strength in those early days; Mr. W. G. Spence, who was then acting as honorary secretary of the Institution, and is now one of the vice-presidents; Sir William H. White, who is, of course, known to you all and is now an honorary member; Mr. R. Doxford, Mr. G. B. Hunter, Mr. P. D. Winstanley, and Mr. John Weir. Out of thirteen presidents, five have passed away, one is seriously ill and seven remain.

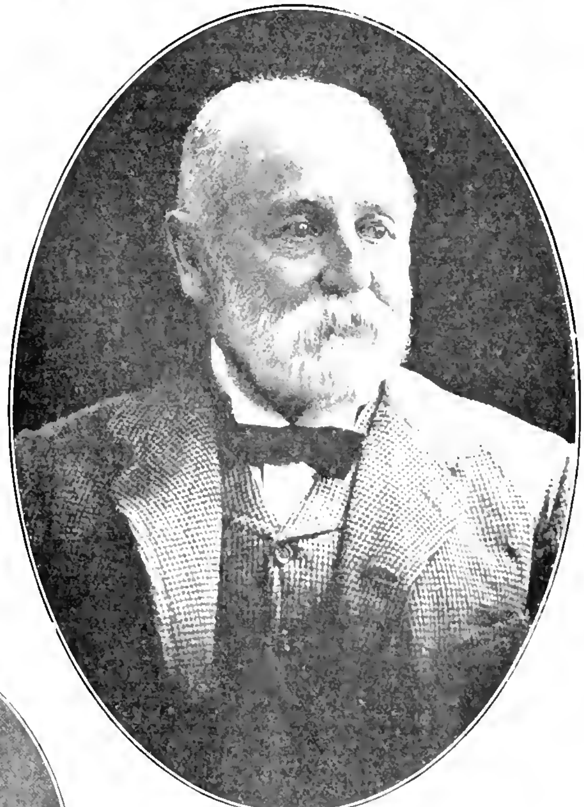
The first meeting, which took place on the 22nd October, 1884, was held in the Surgeon's Hall, and I think I may say that the spirit which actuated the founders has been a moving and vital force throughout the succeeding sessions, and is still operative, and I should like here to call attention to the great amount of work thrown on the president and his council, with little or no show to the ordinary members, but which is nevertheless deserving of the recognition of our members as a whole—more perhaps that it sometimes receives. I may be pardoned if I refer just for a few minutes to some of the developments which have taken place since 1884. At that time, the triple-expansion was just coming into use, and so far as the North-east Coast was concerned, a great deal was due to the effort of the late Mr. Alexander Taylor, for many years a distinguished member of this Institution, and whose name ought not to be forgotten in this connection. At the same time steel ships and steel boilers were taking the place of similar constructions of iron; and speaking before the Institution in 1885, the late Colonel H. F. Swan remarked that he had no hesitation in saying that he believed before any of them were many years older, an iron ship in construction would be as rare a thing as was a wooden one then. Since 1884, we have seen the introduction of electricity, first in the form of lighting, and secondly, and more especially, as a motive power, which has completely changed the aspects of our shipyards and engine works, and has made possible the perfection of the organization that was impossible in former times. Then, we have the genius of our distinguished friend, the Hon. Charles A. Parsons, which has given us a turbine engine and applied it so successfully that it is now not only a system of propulsion adopted in all vessels of war, and in fast passenger vessels—such as the *Mauretania*—but is now in course of being made adaptable to our old friend the "tramp" steamer. Shipbuilders have also devoted great skill and science, not only to the improvement of design and mode of construction, but also to the perfection of the equipment of their shipyards. Personally, I don't think it is too much to claim that the work of Institutions such as ours, by the reading of papers and the discussions on same, has contributed in some degree towards these advances; and also, owing in a great measure to the improved technical education which is engendered at Armstrong College, under our Professors Weighton and Welch, the staffing of our shipyards and engine works is greatly superior to what it was in my early days; and I believe that, great as has been the progress in past years, there is every reason to hope that the advance of future years will surpass it. Social functions such as these are of great value, as they bring members together, and enable them to make one another's acquaintance, but we must not lose sight of the real and vital objects of this Institution, which in the words of our constitution are "The advancement of the science and practice of engineering and shipbuilding." You have a splendid library and other accommodation, which will bear favourable comparison with any other similar Institution, and it is my earnest hope that the Institution will prosper in its new home. Bolbec Hall is built on a site which has been in the heart of a busy and active quarter of this city for 800 years. See to it that you keep a lamp burning there, which will not only honour

Mr. John Duckitt, Secretary.

and respect the past history of the place, but will be a shining light to those who come after us.

The President: Ladies and gentlemen, on behalf of the Institution, I have to thank Mr. Boyd for inaugurating these rooms. His words carry us back to the eloquent and able address he delivered at the opening meeting of the Institution on November 28th, 1884. It is a great pleasure to us, and we feel it an honour, having Mr. Boyd with us to-day at this the maturing of the ideas of twenty-six years ago. It is necessary for me to refer to the inception of this Institution, which was really due to a letter which appeared in local papers in March, 1884, signed by "T. Square," and drawing attention to the necessity in this district for an association similar to the Institution of Engineers and Shipbuilders in Scotland. On the same day Mr. Boyd replied to this letter, stating that if our "Square" friend would make himself known, he would find many to help him. "T. Square" was our friend Mr. W. G. Spence, who is now an honorary life member of the Institution and a vice-president; and associated with him in the preliminary work were Mr. C. W. Hutchinson, Mr. P. D. Winstanley, Mr. B. G. Nichol, and other earnest men. Mr. Boyd threw himself heart and soul into the work, and was elected the first president. He was actively assisted by Mr. Spence as first honorary secretary

Mr. Summers Hunter,
President.



Mr. William Boyd,
First President.

"T Square,"
Mr. W. G. Spence,
First
Hon. Secretary.

Colonel R. Saxton White, V.D.,
President-Elect.

Mr. C. W. Hutchinson,
A Member of the First Council.

and the late Mr. B. G. Nichol as treasurer. Initiated by juniors, the Institution was at once actively supported by our leading shipbuilders and engineers. In the early transactions, we find such names as Messrs. F. C. Marshall, Theodore Doxford, Wigham Richardson, B. C. Browne, W. H. White, Thomas Richardson, G. B. Hunter, Henry Withy, Colonel H. F. Swan, Robert Thompson, Laings. I mention these names to show that representative men from the whole North-east Coast have from the beginning taken a great interest in its work, but its sphere of usefulness and progress has been hampered for want of suitable accommodation. Shortly after its foundation, rooms were secured in St. Nicholas Buildings, and Mr. John Duckitt was appointed secretary and Mr. G. E. Macarthy succeeded Mr. Nichol as treasurer. After serving two years as president, Mr. Boyd was elected chairman of the Finance Committee, and from 1884 up to to-day still holds this position. We find Mr. Boyd closely identified with, and taking a keen interest in, the affairs of the Institution, and always ready to assist and advise. Reference to the Transactions alone will give some indication of Mr. Boyd's close association with the important and successful work of the Institution. It is my privilege—and I account it a high honour—on behalf of the Institution, to give expression of our feelings towards Mr. Boyd. I feel I ought to apologise for the position in which I find myself, because there are many here who have known Mr. Boyd far longer, and who are better able to refer to what is past. I mentioned that it is twenty-six years since the Institution was founded; this is a big slice out of a life-time, and it is a delicate matter turning back these pages of the past. The necessity for such a proceeding comes but seldom, and though there are those here who could more fittingly do this, yet I yield to none in my appreciation of his high character and his unselfish and almost life-long work for the good of others. Some will ask, who is this man? What has he done that we should seek to do him honour? In a word, he is one of those who quietly and unostentatiously is leaving footprints in the sands of time—footprints in which others may follow fearlessly and with perfect safety.

Turning the pages back, we find that Mr. Boyd is a true son of Northumberland, and the fifth William Boyd in direct succession. Educated at Rugby School, he received a practical engineering training at the historical works of Messrs. Sharp, Stewart & Co., Manchester, and afterwards studied science at King's College, London. Thus well equipped for his life-work, he returned to Northumberland, and at this period, commences his association with Tyneside and its industries. Joining Messrs. W. & C. Thomson at the Spring Garden Engineering Works, the firm became "Thomson, Boyd & Company," and whilst there, he became acquainted with the late Mr. Ralph Hart Tweddell, of hydraulic engineering fame, and during the next few years we find them jointly designing and building the first fixed hydraulic riveting machine; this was followed by the hydraulic flanging machine—both of these machines have been developed to suit more modern requirements, and various types are in use in every boiler-shop. It is interesting to remember that they originated on Tyneside. As managing director, Mr. Boyd joined the Wallsend Slipway Company in 1874. It was shortly after this that Mr. Boyd saw that steel would before long take the place of iron. We find Mr. Boyd building about the first steel boilers for marine use, and this was in 1878. From an engineering point of view, this was probably one of Mr. Boyd's best and most interesting undertakings, because it led him to investigate (in conjunction with Mr. Manuel, of the Board of Trade, and later of the P. & O. Company) the use of steel for boiler building. This investigation included a careful testing of the material under various conditions. The results formed the basis of the regulations subsequently issued by Lloyd's Registry for the building of steel boilers. It is interesting to-day to follow these tests, and those wishing to do so will find them embodied in a paper read by Mr. Boyd before the Institution of Mechanical Engineers in 1878. For thirty-six years we find him taking an active part in the operations of this famous Company, yet finding time for useful and valuable work in connection with engineering employers' matters, local affairs, and also in the service of his country. As a Volunteer, he commenced as a private in Manchester whilst an apprentice, and eventually commanded the 1st Newcastle Artillery Volunteers.

Thus briefly, I have referred to what I would call Mr. Boyd's visible or outside work. In connection with these offices and rooms, those who have been in close touch with the negotiations from the beginning can perhaps best appreciate the painstaking care with which he has entered into every detail. Undaunted by the failing health of advancing years, and handicapped by an infirmity that with many a man would have made work an impossibility, some five years ago Mr. Boyd accepted the leading part in these offices and N.E.C. rooms negotiations. Difficulties arose from time to time requiring tactful handling, and those who know will agree with me that, through it all, Mr. Boyd has kept steadily in view the best interests of our industries, as regards the carrying on of the employers' business in these new offices, the organization of the staff, and, at the same time, the necessity for suitable rooms for the advancement and promotion of the educational and scientific part of our work. I wish it to be clearly understood that, though housed in the same building as, and tenants of, the Tyne Shipbuilding and Engineering Employers, yet, the organization of this Institution is in no way connected with the employers' staff. As previously explained, the employers and the Institution required accommodation at the same time. The objects, or the constitutions of the Associations, are widely different, but in the preservation and promotion of our leading industries, our aims and aspirations are the same. Recognising this, it will be seen that the representative committee from the three main organizations, *viz.*, the Engineers, Shipbuilders and the North-East Coast Institution, met together with one aim or consideration in view. Sites and designs for main buildings, proposals as to leasing offices and rooms in various parts of the city were discussed and considered, and eventually Bolbec Hall was decided upon, and the real detail work commenced. The requirements of the various Employers' Associations were to be considered, the apportionment of the necessary offices and rooms, the consideration of leases and rents, etc., the organization of the staff, interviews with the lessors, architects, solicitors and even the naming and description of Bolbec Hall. In all this Mr. Boyd took the leading part. In the early transactions you will find reference to Mr. Boyd's constant courtesy and unwearied attention to the interests of the Institution, and as a result of his close and never-tiring application, this unfailing courtesy and tact, and his consideration for the opinions of others, the work has been brought to a successful termination. In the same painstaking way he took a leading part in the early days of this Institution, and his active connection with and his interest in its operations have continued for twenty-six years. In this quiet way, who shall say that Mr. Boyd has not done a great deal towards building up the commerce and prestige of the district? Commerce and power go together—if our commerce goes we lose our power and prestige among nations.

But, ladies and gentlemen, there is more than this—there is a personal element, there are those of us who have been brought into close contact with Mr. Boyd during these years, and we have learned to respect and admire him for his sterling personal character. Mr. Boyd's example teaches us that we do not work and strive for ourselves alone—it is for others as well as ourselves. Duty has been his watchword; possessing great advantages, in knowledge, influence and sympathy, he has given of these and his time generously. Without spot or blemish, but with a high sense of honour and justice, we can say of him that he tried to do his duty, and the good he has done will live after him. Twenty-six years ago, at the first meeting of this Institution, Mr. Boyd said, "Our aims must be high; that in our discussions we should, young and old, meet on equal terms, and further, to bear in mind that the Institution should embrace not only the Tyne, but also the Wear and Tees." And further on you will find that he expressed the "hope that no word may be spoken, and no act committed among us, other than that which shall be worthy of English gentlemen." Duty again! Thus our Institution commenced, and we hope it will continue. We sincerely hope Mr. Boyd will live long to see the beneficent results of his work for the Institution. Mr. Boyd, on behalf of the Institution, I offer you our most grateful thanks for the valuable services you have rendered to the Institution since its inception. I have to ask your acceptance of this bust and its duplicate as some recognition of all you have done for the Institution, and as a mark of our sincere esteem

and respect. Further, I have the honour to inform you that, at a meeting of the Council on the 4th April last, it was unanimously agreed that Mr. William Boyd, the first president of the Institution, should be elected an honorary member of the Institution, in recognition of the valuable services he has rendered to the Institution.

I cannot finish my remarks this afternoon without a word of congratulation to Mr. Christian Neuper, the sculptor, who has executed the bust of Mr. Boyd in such an able manner. I understand Mr. Neuper has also turned out other important work in the district, including, amongst others, the busts of the late Mr. Alexander Laing, Dr. R. Spence Watson and the late Principal Gurney.

Sir Andrew Noble, called upon by the President, said: I cannot refuse to express myself of the deep gratitude which the employers—and, I may say, the employed—of the United Kingdom owe to Mr. Boyd. It is now more than forty years since I had the pleasure of making Mr. Boyd's acquaintance, and very shortly afterwards—it may be in the recollection of some of you here—we were involved in a very serious quarrel, in which the engineering employers of Newcastle were left by the employers of the United Kingdom to fight their own battle. I need not now draw attention to the great loss that Newcastle then sustained. I think, about fourteen or fifteen years afterwards, Mr. Boyd was instrumental in establishing this Institution, and, shortly afterwards, in greatly assisting in establishing the Institution of the Engineering Employers of the United Kingdom, which have done so much to remove the unfortunate disputes which formerly occurred, and the very serious effects which also followed. During the very many years that the Institution has subsisted, we have all been greatly indebted to Mr. Boyd for his wise counsel, and he has done, I think, more than anybody else in promoting the great efficiency of this Institution. It would be difficult for me to add to the description that your president has given of Mr. Boyd's work; but, on behalf, I may say, of all the engineering employers here, I beg most heartily to thank Mr. Boyd for the great work which he has done.

Dr. G. B. Hunter: I think the privilege of my being allowed to say a few words at this juncture is due to the fact that I have known Mr. Boyd longer, not only than most of those present, but longer than all who are here, with the exception of a very few, and, if I may say so, to being one of Mr. Boyd's oldest friends on Tyneside, and perhaps also to my being a representative shipbuilder, and one of those who owed so much to Mr. Boyd's business enterprise and to his great success as a Tyneside engineer. More than thirty years ago—when I came to the Tyne as a young stranger—one of my pleasantest experiences was, and one of my pleasantest recollections is, that of meeting Mr. William Boyd, and what he was then I have found him during all these thirty years. I found him a real gentleman; a man who acted in the best traditions of English business; a good man of business in connection with his own company, and a man whose word was quite sufficient for anyone who entered into any business transaction with him; a business gentleman who never forgot any of his engagements or responsibilities, and never swerved from them by so much as a hair's breadth in carrying them out. In a word, Mr. Boyd was an example of the best type of an English business man, not only so, but as you have heard, Mr. Boyd was always foremost in the discharge of any public duty. I remember he was a member of the first Newcastle School Board, and therefore helped to inaugurate a universal elementary education which has been so beneficial to our country from that time to the present. He also—as you have heard—was a Volunteer commanding officer, and discharged that duty which every one of us should attempt to discharge, *viz.*, that of fitting ourselves and helping to fit others for the great duty of the defence of our country. Then I remember Mr. Boyd as a member of the governing body of my own town of Wallsend and in every office to which Mr. Boyd has been appointed he has lent dignity to that position, and has not only honoured himself, but honoured those who appointed him to the various offices. He was the first mayor of our town of Wallsend; he was the first president of the North-east Coast Institution of Engineers and Shipbuilders; and he was the chairman of the committee which made all the necessary arrangements as to the position of this beautiful and commodious building, and which made all the necessary arrangements for the work of the Institution being carried on here, and no one who has not had experience of the manner in which Mr. Boyd has discharged the duties of these various offices can fully realize how valuable his work has been. It is of the greatest benefit that every institution should be well started, and Mr. Boyd in this case has inaugurated the work on such good business lines. He has, by the utmost tactful management, "oiled the wheels and made them run smoothly." He has made precedents in all these capacities, and has given us first traditions which have been most valuable to us all, and which, in the case of the North-east Coast Institution of Engineers and Shipbuilders, have never been departed from, but have been maintained, I hope, and I believe, to the present day. I will only now join with those who introduced this subject in expressing the very great respect which we have learnt to feel for Mr. Boyd, and our great respect for him as a master. Mr. Boyd has proved himself one of the best types of English gentlemen, and I join in expressing once more the sincere and heartfelt hope that he will be spared for many years to come to enjoy that respect and esteem which has been shown to-day.

Mr. William Boyd, in reply, said: I can assure you that the second part of the task that has been imposed upon me this afternoon is a very much more difficult one than the first, because for a modest man to find expression in the terms of the very kind way—more than kind way—in which I have been spoken of, and by whom I have been spoken of, and also with whom I have been associated in business and in connection with this Institution for so many years, naturally finds one in a position of very great difficulty and embarrassment. In the first place, I have to thank the president and his Council for conferring upon me the honorary membership of this Institution; this is a very great professional compliment, if I may so distinguish it, because I find myself in the company of men who are known all over the world, such as Sir Andrew Noble, Sir William White, and others; and it is a very proud distinction to be conferred on any man to find himself enrolled in such society. And from a professional point of view, I desire to express my extreme gratitude for this mark of their confidence which they have served upon me in this way. With regard to the bust, I don't profess to be able to appreciate its merits in detail, but I believe that it is generally approved of; there is, however, one point in connection with it on which I wish to say a word, and that is the great care and patience which the sculptor, Mr. Neuper, gave to his work. The President and Council, as you have heard, have been good enough to prepare a duplicate to be placed in my house for the benefit of my wife and children, and, therefore, it is my pleasure to present this bust to the North-east Coast Institution of Engineers and Shipbuilders, begging that they will find a place for it in their library for many years to come, and that it will serve to remind them of one who, at any rate, has always taken a great interest in the Institution, of which he was the first president. Naturally, there come into one's mind on such an occasion as this many thoughts and many ideas, and much feeling, which I really assure you it is impossible to describe. I fear that the compliment that has been paid to me goes far beyond any services I may have rendered either to this Institution or—as has been so kindly said—to the engineering employers of the Tyneside district; but I learnt from my father—and have always kept it in view—that the right and proper thing for a man to do was to try and do something for others as well as for himself. The president has referred to my connection with Northumberland. Well, I believe my fore-elders came here somewhere about the middle of the 18th century, and have been engaged here as bankers and engineers and otherwise ever since. I have to make my sincere apology for the unavoidable absence of my wife and my very great disappointment that she has not been well enough to be present this afternoon, but my daughter has taken her place. Providence has so decreed that I leave no son to continue the name and the work after my time, but I know that my wife and daughter do most gratefully appreciate all the kindness that has been extended to me this afternoon, and I am confident that my grandsons will cherish the name and do their utmost to maintain the reputation which their fore-elders have held in the north country, and above all they will remember the affectionate regard which has been shown to their grand-

father this afternoon. The words I have spoken have, I fear, very inadequately expressed my feelings, but you may take them for what they are worth. I would also say that I very greatly appreciate the kind expressions Sir Andrew Noble made use of, on behalf of the engineering employers, as to any use I may have been to their organization. Sir Andrew referred to the great strike of 1871. I am afraid there will be hardly one left here but Sir Andrew Noble, Sir Benjamin Browne and myself who have any recollection of that. My connection with the Employers' Association does go back for a large number of years. I have to thank you, ladies and gentlemen, most heartily for your attendance here to-day, and for the sympathy you have shown.

The President, Mr. Summers Hunter, on behalf of the Institution briefly returned thanks for the presentation of the bust to the Institution.

Sir W. Theodore Doxford, as the next senior past president to Mr. Boyd, proposed a vote of thanks to the engineering, shipbuilding and repairing firms who had subscribed towards the funds for the furnishing of the rooms.

Sir Benjamin Browne responded.

Colonel R. Saxton White, in moving a vote of thanks to the President, congratulated him upon the success that had attended all his efforts during his term of office, culminating in the success of the present meeting. Mr. Boyd seconded the resolution and the President responded.

The closing business meeting of the session was held in the Lecture Theatre of the Library and Philosophical Society, Newcastle-on-Tyne, after the inauguration of the new rooms, when an interesting paper on a "Project for a Ship Canal between the Tyne and Solway Firth, was read by Mr. J. Watt Sandeman, M.I.C.E. We hope to print this paper *in extenso* in a future issue. Other business done was as follows: The President presented the engineering gold medal to Mr. J. M. Allan for his paper on "Fatigue of copper pipes." Other presentations made were to Mr. T. G. Heckels and Mr. W. R. G. Whiting, M.A. Auditors were appointed. The President read the names of the gentlemen elected to fill the vacancies in the Council list.

Votes of thanks, accorded to the retiring hon. treasurer, Mr. G. E. Macarthy, who has occupied the post for many years, and to the retiring members of Council, concluded the meeting.

INSTITUTION OF NAVAL ARCHITECTS.

Jubilee Congress Celebration Postponed.

IN consequence of the death of King Edward, the Jubilee Meetings, which were to have been held on July 5th and the following days, will not take place this year. The Council trusts that next year it may be possible to celebrate the fifty-first anniversary of the foundation of the Institution under circumstances unclouded by a national bereavement. Those members and firms who have so kindly guaranteed contributions to the entertainment fund are invited to allow their subscriptions and promises to hold good for next year. It will be remembered that King George had promised to open the International Congress.

INSTITUTE OF MARINE ENGINEERS.—At a meeting of the Council of the Institute on May 5th, 1910, the following gentlemen were elected Vice-Presidents of the Institute for Session 1910-1911:—Antwerp, T.W. Fish; Australia, R. E. Thomson, Melbourne, Jas. Macartney, Sydney; Belfast, W. J. Pratten; Bombay, Robert Spiers; Calcutta, J. L. Leslie; Cardiff, George Sloggett; China, James Macdonald, Hong-Kong, J. C. Anderson, Tientsin; Derby, Sir A. Seale Haslam; Dumbarton, P. Denny; Dundee, E. M. Salmon; Egypt, J. E. Roberts; Fiume, Alexander Rolland; Glasgow, James Stark, James Weir; Greenock, P. Caird; Japan, H. E. Metcalf; Karachi, J. D. Fraser; Liverpool, J. Lightfoot; London, Alexander Boyle, Robert Leslie, R.N.R., J. E. Elmslie; Newcastle-on-Tyne, Summers Hunter, James Stewart; Southampton, Robert Elliott, B.Sc.; Royal Navy, Engr. Rear-Admiral E. Little, R.N.; Sea Service, J. H. Evans, A. McClelland, Robert Mollison. Mr. Wm. I. Garnham, of Valparaiso, was elected a Member of the Institute.

LIQUID FUEL AS APPLIED TO LAUNCHES.

THERE has been considerable attention given recently to liquid fuel steam machinery as applied to both large and small marine practice, and many of our readers are probably better acquainted with the larger installations than with the system adopted on launches. We have, therefore, obtained particulars of a modern liquid fuel launch from Messrs. Simpson, Strickland & Co., Ltd., Dartmouth, and illustrate the complete system herewith.

The launch in question was constructed last year to replace a motor launch on a large yacht, the silence and reliability of the steam set being found to outweigh any advantages the motor was said to have.

The hull is 32 feet long by 7 feet beam, built of mahogany, and with a small cabin aft of the machinery

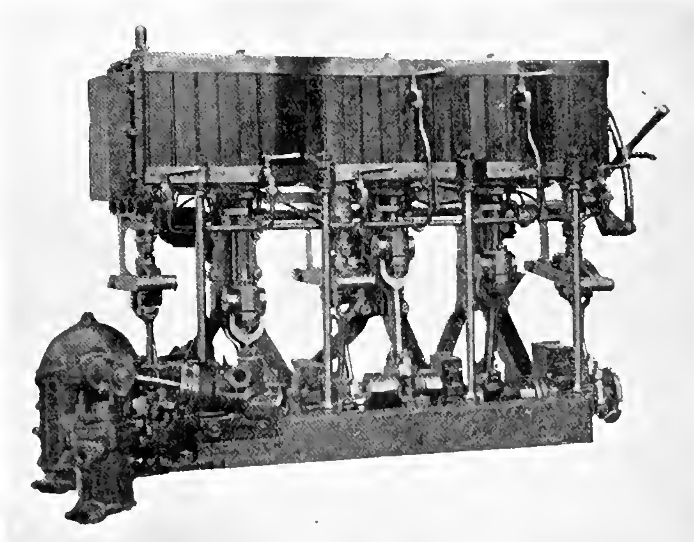


Fig. 1.

open to the cockpit. The first consideration with the hull was a good sea boat, and with the machinery reliability. The engine illustrated in Fig. 1 is one of Simpson Strickland's "silent triples," the cylinders being $3\frac{1}{4}$ in., $5\frac{1}{4}$ in. and 8 in. in diameter by 4 in. stroke, developing 34 i.h.p., fitted with feed and air pumps driven by worm gearing and noted for its steady and silent running.

The burner is of the Lune Valley patent type, an illustrated description of which was given in "The Marine Engineer and Naval Architect," October, 1908, on reference to which the construction will be clearly seen. Paraffin oil is used under a pressure of from 20 to 30 lbs., and passes through the coils, where it is converted into a gas, to the nozzle. The jet impinges on the deflector, over which it spreads in a thin film, taking up exactly the right amount of air for complete combustion. The flame is regulated by the needle, which projects through the nozzle, and is operated by a hand lever as shown. It will be noted that every time the flame is regulated the needle performs a clearing action in the nozzle and prevents it from becoming clogged up, hence no "prickers" are required.

Although the burner is the most important part of a liquid fuel set, it is not the only point to be considered. Careful attention must be given to the methods of supplying the oil under pressure to the burner. We therefore illustrate in figure 2 the arrangement of fuel tanks, pumps and pipes. A small steam-driven fuel pump is provided with a suction from the main storage tanks, and delivering into a small pressure tank. This small pressure tank is fitted with a relief valve and overflow pipe back to the storage tanks. Hence it is impossible to exceed a given pressure, and by the help of an air cushion in the pressure tank it is very simple to maintain a constant pressure on the fuel—a very important point. All the fuel pipes are arranged to be well in view to ensure no unseen leaks. We understand that Messrs. Simpson, Strickland & Co. have applied this system to many boats with great success.

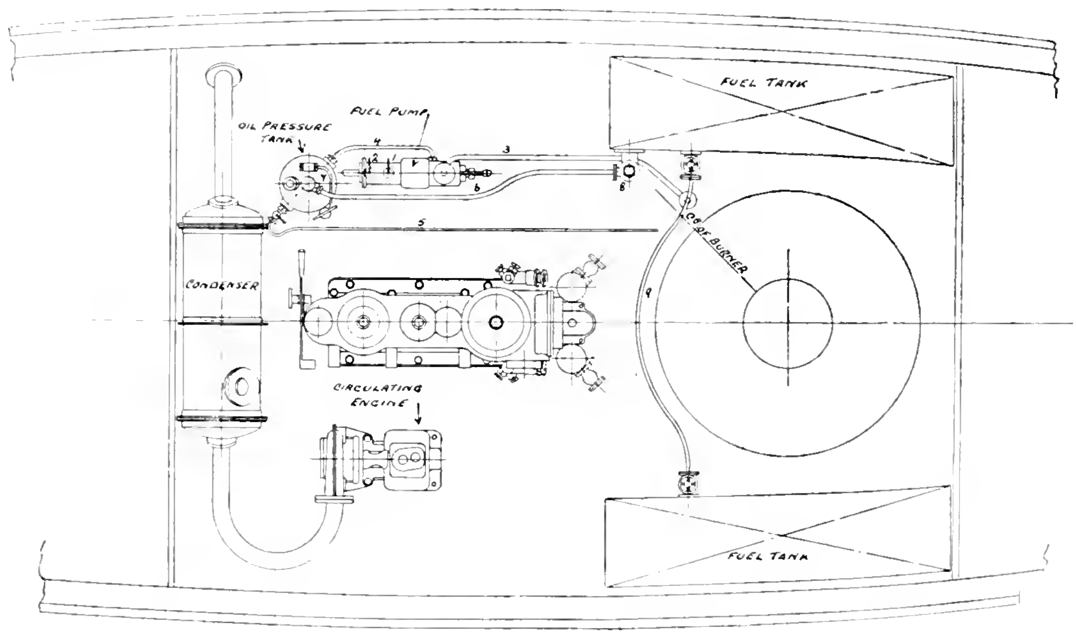


Fig. 2.

In smaller sizes the main tank is constructed to withstand the pressure, and a small air pressure pump is fitted to pump air into it, thus forcing the fuel to the burner.

Messrs. Leonard Chapman & Co., Ltd., Importers and Manufacturers, Munton Road, London, S.E., report:

Graphite, as imported, according to quality.

	£	s.	d.		£	s.	d.	
Ceylon L.L. c.i.f. London ..	17	0	0	to	39	0	0	per ton
,, O.L. ,, ..	12	10	0	to	39	0	0	,,
,, chips ,, ..	10	10	0	to	20	0	0	,,
,, dust ,, ..	8	10	0	to	24	0	0	,,
Purified, milled and ground.								
Ceylon, 97% to 99%, f.o.b. London	59	0	0	to	63	0	0	per ton
,, 90% to 91%, ,,	40	0	0	to	42	0	0	,,
,, 80% to 81%, ,,	30	0	0	to	32	0	0	,,
,, 70% to 71%, ,,	27	0	0	to	29	0	0	,,
American large flake, f.o.b. London	47	0	0	to	50	0	0	,,
,, small ,, ,,	38	0	0	to	47	0	0	,,
,, powdered ,, ,,	28	0	0	to	36	0	0	,,

Wholesale lists of tinned goods on application.

REVIEWS.

Directory of Merchants, Manufacturers and Shippers of the World for 1910. London: Kelly's Directories, Ltd.

We have received a copy of the 1910 edition of the above work. It contains over 2800 closely-printed pages, exclusive of 278 pages devoted to the indices. Though the book is not claimed to be free from errors, yet it is safe to say that the proprietors have spared no pains to make it as correct as possible. The information given relates to nearly 20,000 foreign and colonial cities and towns and there are nearly 1,250,000 trade classifications under them. The indices give some 150,000 references, and by using the first index the place relating to any individual can be found in a moment. With equal ease, by referring to the index to trades, can be found any merchant carrying on any particular trade in any particular place. The directory should be of much value to those anxious to extend their foreign trade or to open up new branches in foreign countries, for they will find information not included in any other directory. Full information is given as to the regulations in force with reference to commercial travellers and their samples, for instance, in Cape Colony and in some of the provinces of the Argentine Republic they are taxed £50 a year, and even in Sweden and Norway £5 a month. With a view to still further add to the usefulness of the directory the proprietors have added alphabetical lists giving the names of the really important traders of all kinds in the United Kingdom, with their telegraphic addresses. The object of these new sections, comprising 465 pages, is to enable the English or foreign trader to ascertain at once the full address and exact character of the business carried on by any particular merchant or firm with whom it may be desired to communicate.

Condensing Plant. By F. W. Wright. London: The Technical Publishing Co., Ltd. Price 3s. 6d. nett.

This book is an attempt to deal with the design and construction of the condensing part of a steam plant in a consistent and systematic manner. In view of the large amount of attention that this subject has had for the past few years it is somewhat remarkable that so little has been done in the way of collating the information scattered throughout the technical press and in the published records of the various engineering societies. The author is to be congratulated on an earnest effort to fill the want of a short concise treatise

of the subject. The problem of the transference of heat from steam to water and the methods by which this is accomplished, together with the elimination of air leakage and withdrawal of air and vapour and the possibilities of water cooling for continuous use by means of reservoirs and cooling towers are mainly dealt with on broad grounds without any special reference to details of mechanical construction, although in some instances, of course, the function is not easily explainable without such details. Much of the matter has already appeared in the "Mechanical World," but its present form renders it a useful and convenient text-book for ready reference.

The Gas Turbine. By H. H. Suplee, B.Sc. London: Charles Griffin & Co., Ltd. Price 12s. 6d. nett.

This book is a compilation of theoretical and practical data relating to gas turbines for engineers and experimenters. It is recognised that such machines are yet in the experimental stage and their future development is still in the clouds from a practical standpoint. A considerable amount of pioneer work has been done in England, France, America and Germany, which has been reviewed in papers read before the various scientific societies. With a view of providing a comprehensive treatise on the subject, the author has collected all the available information. The book begins with an historical treatise, dealing with development of the subject from the smoke jack, generally attributed to Leonardo di Vinci, down to the 300 H.P. gas turbine of M. M. Armengand and Lemak. Papers read on the subject before the Institute of Mechanical Engineers and the Society of Civil Engineers of France, together with discussions and comments thereon by well-known authorities, form an interesting and important part of the book. There is little doubt that those taking part in the research of this branch of science will find that much time and labour will have been saved them by this concise and comprehensive treatise of a subject of which much is yet to be learnt.

Engineering Workshop Machines and Processes. By F. Zur Nedden. Translated and revised by John A. Davenport. London: Constable & Co., Ltd. Price 6s. nett.

The German edition of this book was written to assist the young men who, in accordance with the scheme adopted in that country, spend one year in the workshop before proceeding to the University or High School. Having regard to the fact that the features in the present English requirements differ from the German, the translator has modified the matter accordingly to bring it into line for the use of the English student. The Institution of Civil Engineers have given permission for the reproduction of the excellent report on the education and training of engineers presented by a special Committee in 1903, and Sir Alexander Kennedy has contributed to the volume an introduction which is written in his usual thoughtful and kindly strain, indicative of the true sympathy which should exist between the teacher and the pupil. The book deals generally with matters of practical significance, and its object is to train the young engineer to be observant, indicating in what way his mind must be directed and the use he must make of the observation made. A typical up-to-date engineering works is described and the importance of the arrangement of work to reduce cost of labour, transport and standing charges. Materials of construction, the foundry and pattern shop forging, the machine shop and measuring and marking off are dealt with in separate chapters, and the essential value of the designer being fully acquainted with constructive detail is repeatedly emphasized. We are sure that no student of engineering will fail to derive great benefit from the study of this book, whatever branch of the profession he may be working up for.

Dock Engineering. By B. Cunningham, B.E. Second edition, revised. London: Charles Griffin & Co., Ltd. Price 30s. nett.

This revised and improved edition now contains 600 pages, and is illustrated with 35 folding plates and 468 diagrams in the text. The first edition was published in 1904, and considerable progress has been made since then. As maritime engineering is a science of peculiar and vital importance to the national and commercial welfare of an insular people, therefore, it is of great importance that Britishers should be up-to-date in all the information appertaining to the subject. The first and second chapters have been thoroughly revised and rewritten, a new chapter has been added dealing with the special adaptation of reinforced concrete to dock work and a number of appendices have been included to supplement various textual alterations throughout the volume. It was intended, and preparations had been made, to include as an appendix the impending revised issue of the British Standard specification for Portland Cement, but owing to the process of revision being so prolonged this idea has had to be abandoned, and consequently any reference in the text must be interpreted in the light of this information. This book, which is the work of an engineer of great ability and practical experience, must of necessity form part of the library of every engineer interested in this branch of engineering who wants some source of reference to problems already solved and the method of solving them in order to guide him in the solution of other problems.

Kelly's Customs Tariffs of the World, 1910. Price, nett, 10s. London: Kelly's Directories, Ltd., High Holborn.

We have received a copy of the 1910 edition of the Customs Tariffs of the world. The book is stated to be the most complete work of its kind which has ever been published in English or in any other language, and we can well believe the claim. Every care has been taken to ensure correctness of the information, but obviously it is impossible that every item can be correctly set out, owing to new Tariffs being constantly framed and alterations made to existing ones. The present volume contains the new Tariffs which have recently come into force for several countries. Some little delay has been caused in the appearance of the present volume in order to include the new French Tariff. The constant expansion of the different Tariffs is shown by the steady increase in the size of this work, the number of pages in 1905 being 729, and in the 1910 edition 975. The book meets a distinct need of commercial people in all countries, as it enables any merchant to tell at a glance, the duty, if any, levied in any country on any exported or imported article.

Taschenbuch für Schiffsingenieure und Seemaschinisten. Second edition. Price, Mks.: 5.50. By Ludwig and Linder. Munich and Berlin: R. Oldenbourg.

This is a useful volume of data for marine engineers, a little over 400 pages, not too large to carry in a coat pocket when desired. The book has numerous practical illustrations, and deals with the subject in parts devoted to mathematics, physics, the marine engine, including steam turbines, boilers, pumps, auxiliary engines, electro-technics, instruments, naval architecture, nautics, laws and tables.

Schiffsturbinen. By Bauer and Lasche. Ergänzungsband zu Bauers Berechnung und Konstruktion der Schiffsmaschinen und Kessel. Price, Mks.: 8. Munich and Berlin: R. Oldenbourg.

This volume, which deals with marine turbines, was promised as a short supplement in the original work, which would not be complete without a treatise on steam turbines. Dr. Bauer, a Director of the Stettiner Vulcan and Mr. O. Lasche, Director of the turbine works of the A.E.G., Berlin, have co-operated with others to carry out the earlier promise, and have redeemed the same in a very creditable manner. The present volume contains 104 illustrations and many tables, and deals with the subject as exhaustively as is possible in 200 pages.

BOOKS AND CATALOGUES RECEIVED.

Hydrographic Surveying, Elementary. By Commander Stuart V. S. C. Messum. Price, nett, 12s. London: Charles Griffin and Co., Ltd., Strand.

Shipping Office Organisation, Management and Accounts. by Alfred Calvert. Price, nett, 5s. London and Bath: Sir Isaac Pitman and Sons, Ltd.

MESSRS. DAVIS & RANSOME, of Caxton House, Westminster, have been appointed sole agents in London and the South of England for the Buffoline Noiseless Gear Co., of Levenshulme, Manchester. The Buffoline Co. are noted for

their hide and paper pinions and for metal gearing of all description. A copy of the Company's Catalogue will be sent on request.

THE SMOOTH-ON IRON CEMENTS.—We have received a copy of the ninth edition of the Smooth-On Instruction Book. The Instruction Book is a new issue and only recently published. It tells all about Smooth-On Iron Cements, Sheet Packing and Corrugated Metal Gaskets, and shows when, where and how to use them. The illustrations are made from photographs of actual subjects and show some of the many ways in which the Smooth-On Cements have been used. A copy of the instruction book will be sent free to any one sending his name and business address to the Smooth-On Manufacturing Co., of Communipaw Ave., Jersey City, U.S.A.

A. J. CRIGHTON.

Born Birkenhead, 1867, died Antwerp, April 16th, 1910.

THE above is reproduced from a photograph found among the papers of the late Mr. A. J. Crighton, an obituary notice of whom appeared in our last issue, and which we now supplement along with the portrait. Mr. Crighton, during his last years of sea-service, was in the Red Star Line of steamers, and obtained his Chief Engineer's Certificate in 1893. He was Chief Engineer of the Red Star liner *Berlin*, when bought by the United States Government for transport service during the American-Spanish war. At the termination of this service he joined Mr. Béliard as co-manager in the Vulcain Belge, Antwerp, and his personal and business qualities made him well known and esteemed. About 1903-4 the firm of Messrs. Béliard, Crighton & Co. was formed, and by energy and close attention to the demands of work, the firm prospered. The loss of Mr. Crighton, to his partner, is more than a business one; it is a personal loss, due to close association and mutual help in founding the firm and bringing it up to its present standing. Mr. Crighton's father was for many years Marine Superintendent for the Red Star Line, and was widely known and respected. He was instrumental in saving the steamer *Three Belles* and 350 passengers, a feat which evoked many deserved complimentary tokens of esteem.

OBITUARY.

Captain A. W. Jeffery.

WE regret to put on record the death of Captain Arthur Wellesley Jeffery, F.R.Met.Soc., Nautical Surveyor to the Board of Trade, which occurred at his residence in Cross Hill, Glasgow, on May 2nd. Deceased, who was a native of Devonshire, and in his fifty-fifth year, sailed in early life as captain in the employment of the Lamport and Holt Line of steamers, and for several years was in the steamers carrying the mails from Antwerp to River Plate. After leaving the sea, he obtained an appointment as Nautical Surveyor to the Board of Trade in Liverpool, and was stationed there for six or seven years, after which, and about ten years ago, he was transferred to a similar position in Glasgow. He took a great interest in the nautical classes of the Glasgow Technical College. He was a recognised authority on life-saving, and in the course of his career was the means of saving from drowning eighteen lives, and had the Royal Humane Society's Medal. He took an especially keen interest in the subject of storms at sea and shipwreck, and frequently delivered lectures on this subject, having amassed a large and unique collection of photographs of notable shipwrecks and shipping catastrophes. He was also keenly interested in all scientific subjects and especially in astronomy. While residing in Liverpool, he acted for some time as secretary for the Liverpool Astronomical Society, and after his transfer to Glasgow, he joined the local branch of the British Astronomical Association. He took a prominent part in connection with its affairs, and for some time past he had been urging captains and others to co-operate in endeavouring to secure observations of interest in connection with the close approach of the earth and Halley's Comet during the month of May. In his younger days Captain Jeffery was a distinguished swimmer, and in 1874 he won the Championship of England.

THE INSTITUTION OF CIVIL ENGINEERS.—In consequence of the death of His Majesty King Edward VII. the Council have decided that the Institution Conversazione will not be held this year. At the annual general meeting the election of officers was declared as follows:—President: Mr. Alexander Siemens. Vice-Presidents: Dr. W. C. Unwin, Mr. R. Elliott-Cooper, Mr. Anthony G. Lyster, and Mr. Cuthbert A. Brereton. Other members of Council: Mr. John A. F. Aspinall (Liverpool), Mr. B. Hall Blyth (Edinburgh), Mr. John A. Brodie (Liverpool), Mr. William B. Bryan, Col. R. E. B. Crompton, C.B., Mr. Wm. Davidson (Australasia), Mr. E. B. Ellington, Mr. Maurice Fitzmaurice, C.M.G., Mr. J. P. Griffith (Ireland), Sir Robert A. Hadfield (Sheffield), Dr. Charles A. Harrison (Newcastle-on-Tyne), Mr. Walter Hunter, Mr. G. R. Jebb (Birmingham), Mr. Harry E. Jones, Sir Wm. Thomas Lewis, Bart., K.C.V.O. (Aberdare), Mr. Hugh D. Lumsden (Canada), Sir Thomas Matthews, Hon. Charles A. Parsons, C.B. (Wylam-on-Tyne), Mr. Alexander Ross, Mr. J. W. Shores, C.M.G. (South Africa), Mr. Francis J. E. Spring, C.I.E. (India), Mr. John Strain (Glasgow), Sir Frederick R. Upcott, K.C.V.O., C.S.I., Sir Philip Watts, K.C.B., Mr. W. B. Worthington (Derby) and Mr. A. F. Yarrow (Glasgow).

THE *Hercules*, sister ship to the *Colossus*, was recently launched at Jarrow. Elaborate arrangements had been made by the Palmer Shipbuilding & Iron Co. of Jarrow-on-Tyne, but owing to the death of King Edward, the ceremony was a quiet one. She has a displacement of 22,500 tons. The turbine engines made by the Palmer Co. develop 25,000 H.P. and she is designed to give a speed of 21 knots. The total cost will be about £1,700,000. She has taken only ten months to build, which speaks well for the resources of the Palmer Co.

WHITE STAR LINERS "OLYMPIC" AND "TITANIC." The progress in the construction of these two leviathans is proceeding apace, the *Olympic* is fully plated, and the *Titanic* in frame. The deck plating of the first named vessel is also well advanced. The huge gantries under which these two vessels are being built have for the past year been recognised as a landmark in Belfast Harbour, but the vessels themselves now take the eye of every observer, and the launch of the *Olympic*, which is now being looked forward to with so much interest, will be in many ways the most important and eventful feat so far in the history of shipbuilding.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Clyde Wages Agitation.—For a year or more, with the exception of a demand by the engineers for an hour less work a week at the same rate of pay, the relationship between shipyard employers and employees on the Clyde has been undisturbed. The conditions of the shipbuilding and engineering industries a little over a year ago were so bad that the men accepted a reduction of ¼d. per hour. For some months past marked improvement in the shipbuilding and engineering industries has taken place, and although the employers maintain that had they not "cut" prices to the very lowest, the orders which have recently been received would either not have been placed or gone elsewhere, most of the principal branches of trade in the shipbuilding yards and engineering shops have at the time of writing applied for an advance. Action was first taken by the pattern-makers, brass-moulders and engineers, and more recently the blacksmiths, coppersmiths, brass-finishers and other sections of the shipbuilding and engineering industries have followed suit. Practically all the engineering trades have thus applied for an increase, in each case of ¼d. per hour on the present rate, or, as the men prefer to put it, the restoration of the reduction made in January last year when, owing to the dullness of trade, wages were reduced from 8d. to 7¾d. The North-west Engineering Trades Employers' Association have already informed the brass moulders that they cannot see their way to grant the increase asked for. In the case of the engineers the application was made on May 15th, and the proposal is that the advance asked for should take effect on and after June 15th. In this way the usual month's notice has been given. The letter will come before an early meeting of the Employers' Association, and in all probability a conference will be arranged between representatives of the association and of the four Clyde District Committees of the A.S.E., those of Glasgow, Greenock, Paisley and Dumbarton. In the event of this conference failing to effect a settlement, the matter will almost certainly be appealed to Central Conference, so that the negotiations will likely extend over a longer time than the month's notice. Pending the conclusion of all the negotiations, however, work must proceed as at present. It is almost certain that if the employers do not meet all the sections of workmen in one common conference the same policy will be made to apply all round, and that an advance will not be given in any one trade unless the employers are prepared to give a similar advance to all the others.

Prospective Allan Liners.—The directors of the Allan Line have invited shipbuilders to tender for the construction of two large turbine steamers for the passenger service between Liverpool and the St. Lawrence. The vessels will each be over 20,000 tons gross and they will have a speed which will enable them to land passengers at Quebec in less time from Liverpool than the fastest Cunard liners can land them at New York. Their speed will not, of course, be equal to that of the *Lusitania* or *Mauretania*, but the voyage to Quebec, being shorter than that to New York, can be done in less time by boats of lower speed. The new vessels will be about twice as large as the Allan liners *Victorian* and *Virginian* which, it will be remembered, were the first Atlantic turbine steamers, and were built respectively by Messrs. Workman, Clark and Co., Belfast, and Messrs. Alex. Stephen & Sons, Linthouse. The Allan Line, at present, share the Canadian mail-carrying contract with the Canadian Pacific Co.'s steamers, and it is believed that they intend, by building these two fine steamers, which will easily be the fastest on the Canadian service, to retain, if possible, the whole of the mail contract when it comes to be renewed.

The Fairfield Shipbuilding and Engineering Co., Govan, have booked the order for a large intermediate steamer for the Union Castle Mail Steamship Co.'s South African service. In addition to bringing to the trial trip stage of H.M. cruiser *Glasgow*, which was launched last September, this Company have recently got out of hand a highly important overhaul contract in the mail steamers *Royal Edward* and *Royal George*—formerly the *Cairo* and *Heliopolis* respectively. The *Royal George* was put through her trials on the Clyde on May 16th, coming through them satisfactorily, and thereafter proceeding to Avonmouth to take the second sailing in the new service of the Canadian Northern Steamships, Ltd. She was expected to arrive at Avonmouth on May 20th, and was booked to depart from there on her first voyage on May 26th. She has been in the builders' hands since the end of November last, and was preceded by her sister ship the *Royal Edward*. Both vessels were originally built by the Fairfield Co. in 1907 for the Egyptian Mail Steamship Co.'s fast Mediterranean service and carried on that service for some time, until sold eventually to the Canadian Company.

Messrs. John Brown & Co., Clydebank, have been commissioned by the Orient Line to build and engine a new twin-screw mail steamer similar to the *Orsova*, the first to be delivered of the five similar vessels completed for the service last year. The Clydebank firm, after satisfactory speed trials, handed over to her owners, the Huddart Parker & Co. Proprietary, Melbourne, the twin-screw steamer *Zealandia*, for the passenger and cargo trade on the Australian coast. She completed her trials in the second week of May, when the speed on a continuous run of nine hours' duration was 15·8 knots—very considerably in excess of the contract requirements. After her trial the vessel attained a mean speed, with full load of cargo and coals on board, of 16·1 knots on the measured mile.

Messrs. Wm. Beardmore & Co., Dalmuir, are not unnaturally gratified at the fact that the gunboat *Rattler*, on which they fitted some years ago gas engines and producers for propulsion, and with which extensive experiments have since been carried out, has been transferred from the Clyde to Portsmouth for the purpose of instructing naval stokers in the mechanism of suction gas propulsion. This is regarded as a step toward fitting the unarmoured cruisers of the programme of 1910-11 with gas engines. The substitution of gas for steam as the motive power will not only enable the ships to have greater speed, but will generally improve their fighting efficiency as well, and it is not unlikely that this may be followed by the fitting of heavier armoured cruisers and battleships with the same type of prime mover.

Messrs. Barclay, Curle & Co., Whiteinch, have secured the contract to build an intermediate steamer for the Union Castle Co.'s South African service, similar to that above noted as having been secured by the Fairfield Co.

Messrs. Yarrow & Co., Scotstoun, have been commissioned to build two out of the six special torpedo-boat destroyers which the Admiralty have just placed with firms at various centres. These vessels are, in their main particulars, similar to the standard type, but it is understood that the contractors will be allowed, within a certain limit, to try to get a better speed than that stipulated for the others, of which sixteen are to be ordered. Messrs. Yarrow & Co. launched on May 10th the *Sergipe*, the last of the ten destroyers ordered by the Brazilian Government, and have now successfully put through her official trials the ninth vessel of the lot—the *Parana*. On the measured mile at Skelmorlie on May 18th a mean speed of 28·736 knots was attained during a continuous run of three hours, the mean air pressure being 2 inches. The contract speed of the vessel carrying a load of 100 tons is 27 knots. The dimensions of the *Parana*, as of the other vessels, are:—Length, 240 ft., beam 23 ft. 6 in. Steam is supplied by two double-ended Yarrow boilers of the latest type. In these Brazilian destroyers strength of construction and good sea-going qualities were deemed—as in the British Navy—of even greater importance than high speed. Both the British and Brazilian destroyers have a guaranteed speed of 27 knots. The first seven of these destroyers are now in Brazil and the eighth will leave the Clyde shortly.

Messrs. Wm. Denny & Bros., Dumbarton, will in all likelihood receive from Messrs. The Parsons Turbine Co., Ltd., Wallsend-on-Tyne, who are the actual contractors for two of the six special torpedo destroyers just given out—and of which as above noted Messrs. Yarrow & Co., Scotstoun, are to build and engine two—the sub-contract to build the hulls of the vessels. The Dumbarton firm's success in this special class of ship construction, and the success which has attended their collaboration with Messrs. The Parsons Turbine Co., in river and channel passenger turbine steamers, afford fair guarantee of high success with these up-to-date destroyers.

Messrs. Scotts' Shipbuilding and Engineering Co., Greenock,

have received an order to build and engine a steamer of 7,000 tons for English owners.

Messrs. Russell & Co., Port Glasgow, have received an order to build a steamer of 6,000 tons for Messrs. Shankland and Co., Greenock.

The Ailsa Shipbuilding Co., Troon, have received an order for a twin-screw passenger and cargo steamer for colonial owners. The vessel will have extensive first and second-class passenger accommodation, and will also carry a considerable quantity of cargo. Twin-screw, triple-expansion, four-cylinder balanced engines will be fitted, and also four multi-tubular boilers designed to give the vessel a speed of 18 knots loaded.

Beardmore Naval Guns.—Messrs. Wm. Beardmore and Co., Parkhead Forge and Steel Works, Glasgow, who, as recorded at the time, despatched to Woolwich in November and December last the two first heavy wire-wound guns ever made in Scotland, have received a further order from the British Admiralty for three of the largest type of guns for the Navy. They have also on hand the manufacture of several six-inch guns and a considerable number of four-inch bore. The latest order is for what are technically described as 12-inch Mark XII. wire-wound guns. The first of the previous guns referred to, as described by Rear-Admiral Adair, manager of Messrs. Beardmore's gun factory, was a 12-inch 50-calibre of 68 tons weight intended for use on one of the most recent British battleships of the "Dreadnought" type. All the processes of manufacture were carried out by Messrs. Beardmore—the casting of the steel ingots from which the different tubes were made, the tempering, the shrinking, the machining of the parts, the wire-winding, the boring and rifling and the final finishing in the turning shop. This first gun was despatched to Woolwich, there to be fitted with hydraulic breech gear, and then "proved" on special mounting, after which it was ready to be placed on board a battleship. Previously the making of such guns has been confined, so far as Britain was concerned, to the English firms which specialize in the making of ordnance. This gun was the heaviest piece of work that had ever left Parkhead Forge, the previous heaviest having been forgings of about 25 tons intended for guns manufactured elsewhere. The receipt of this later contract by the Glasgow establishment may be accepted as indicating the entire satisfaction of the naval authorities with the Parkhead manufactures, and that Messrs. Beardmore & Co. will receive a more liberal share of orders for naval guns to be given out in the future. Each of the new big guns will cost something like £12,000 and will take a year or so to prepare. The 12-inch standard gun of the British Navy is 50 ft. long and weighs 68 tons. It fires a projectile of 850 lbs., and can perforate over four feet of solid iron at close range. The smaller guns above referred to as being also on hand at Parkhead are intended—the six-inch for second-class cruisers, and the four-inch for the secondary armament of battleships. The latter are used for defensive purposes against torpedo boat attack. They are handy little guns, weighing about $2\frac{1}{2}$ tons each, capable of being fired with great rapidity.

Leith Dockyard Improvements.—Leith Dock Commission at its meeting on May 13th, approved of a recommendation by the Works Committee that the sill of the new dry dock should be made one foot lower than originally specified. On submission of a report by the Works Committee it was resolved to finally abandon consideration of any scheme to develop Newhaven as a detached harbour. The scheme elaborated by the superintendent for the linking up of Newhaven with Leith, which strongly commended itself to the committee, was recommitted for further consideration and to report more fully on the financial aspect

TYNESIDE AND WEARSIDE.

(From our Own Correspondent.)

Tyneside.

The Tyne as a Naval Base.—At the annual meeting of the Newcastle and Gateshead Chamber of Commerce the subject of the Tyne as a naval repairing base received additional attention by the speech of the chairman, Lord Joicey. He was unable to understand the policy of the Government in not providing docks on the East Coast which would be capable of effecting the repair of ships of war of the largest size in the event of naval operations, and stated that he had been informed on good authority that another important naval power would have in 1912 no less than eleven "Dreadnought" docks. He considered that in no other part of the country were there so many advantages for a naval repair base as on the Tyne. He thought that the question was very much more serious than the Government appeared to realize.

Messrs. Palmers' Shipbuilding and Iron Co., Ltd.—Although there was, as a matter of course, considerable disappointment in Tyneside that the death of King Edward rendered it impossible for the Princess Louise to perform the launching ceremony of H.M.S. *Hercules* at Jarrow, it was universally recognised that no other course could be adopted than to have the function as quiet as possible. This did not, however, prevent the launch being witnessed by a dense throng of people on either bank of the river. Lady Furness gave the name to the vessel, and a short religious ceremony was also undertaken. Messrs. Palmers are now busy in their recently-erected turbine shops in constructing the engines for the vessel, which are to have an aggregate of 25,000 horse power in order to give the vessel 21 knots. The local press remarks on the fact that whereas Messrs. Palmers had the distinction of launching the first vessel of the British Navy in the late King Edward's reign (the *Russel*) they are again interested in the first naval launch in the reign of King George V.

Messrs. Armstrong, Whitworth & Co., Ltd.—Government work is especially prominent on the Tyne at present, and the British cruiser *Newcastle*, the progress of which at the Elswick yards of Messrs. Armstrong, Whitworth & Co., Ltd., has before been noted in this column, is now proving her seaworthiness. The vessel has been taken to sea in charge of a crew from H.M.S. *Vindictive* for extended steam trials, and the reports received hitherto indicate that the mechanical portion of the vessel's equipment is meeting satisfactorily all tests placed upon it, with the exception of a slight breakdown of the turbine machinery, necessitating minor repairs.

Messrs. Hawthorn, Leslie & Co., Ltd.—In all the branches of this firm work is proceeding very briskly. In the turbine department the engines for the *Monarch*, the "Dreadnought" type warship which Messrs. Armstrong, Whitworth & Co. are building at Elswick are under way, while it is announced that the firm has secured the contract for the turbine engines of 18,000 horse power to be placed on board the first of the new unprotected cruisers which are to be built at Pembroke dockyard. These engines are to be of the same type and size of those built by Messrs. Hawthorn, Leslie & Co. for the unprotected cruiser *Blanche* last year. In the shipyard department a very interesting vessel for a Swedish firm, the *Sir Ernest Cassel*, was launched for the purpose of the ore-carrying trade. The vessel has twelve Johnson-Welin gravity discharge ore pockets, fed by large electric cranes on board, by which the ship can be worked so continuously that time and expense are considerably reduced. The North Eastern Marine Co., Ltd., supplied the machinery.

Messrs. Swan, Hunter & Wigham Richardson, Ltd.—It is reported that the Cunard Company have given this firm an order to build a sister ship to the *Franconia*, which is now in course of construction. The new vessel, which is to be of the intermediate class, will be 600 ft. long with a moulded depth to the bridge deck of 52 ft. 3 in. The loaded draught will be about 27 ft. 6 in., giving about [illegible] tons displacement and 10,000 tons deadweight capacity. The engines of the twin screw quadruple-expansion type are to be built by the Wallsend Slipway Co., and are to have 12,500 h.p., giving the vessel about 17 knots per hour. The new vessel is to be used in the Mediterranean and United States passenger service.

General.—The *Newcastle Daily Chronicle* draws attention to the fact that there are now in course of construction on the Tyne about thirteen warships the displacement tonnage of which is about 81,000 tons. This is roughly speaking double the tonnage of warships in construction on the Tyne a year ago. In addition there are about [illegible] tons more merchant shipping in course of building on the Tyne than at this time last year, and therefore the labour market and the state of trade, both in shipbuilding and its allied industries, is greatly improved.

Wearside.

Messrs. Robert Thompson & Sons, Ltd.—The Southwick yard of this firm shows very greatly increased signs of activity. A large cargo steamer, the *Remembrance*, for a local shipping firm, has just been launched, while the London firm of Messrs. France, Fenwick & Co., has just placed an order with Messrs. Thompson & Sons for the construction of a vessel. Another item of unusual interest is that the firm is now engaged in finishing a vessel for a Continental firm, the Dampfschiffahrts-Gesellschaft "Neptun," of Bremen, in spite of foreign competition in shipbuilding.

Messrs. Wm. Doxford & Sons, Ltd.—Messrs. Doxford are busy more particularly with the turret deck steamers which they have made their speciality, having just launched a large vessel of this type of 8,000 tons deadweight capacity. They have also received a recent order from the Eskside Steam Shipping Co., of Whitby, for two steamers, each having 6,000 tons deadweight capacity. The engine department of this firm is also busy.

Messrs. Short Bros.—This firm reports that, with the work already in hand and orders recently received, they will be kept fully going for more than a year ahead. The most recent order is from the Taylor & Sanderson Steamship Co. of Sunderland, which is for a trading vessel of 6,500 tons deadweight capacity.

Messrs. George Clark, Ltd.—Messrs. George Clark, Ltd., of Southwick, are also experiencing the effects of the revival of shipping trade. They have in hand the engines for the boat mentioned above as under construction by Messrs. Short Bros., while they recently engined the *Remembrance*, built by Messrs. Robert Thompson & Sons, Ltd.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, have made great progress with the two steamers building for Liverpool owners to Messrs. W. Esplin & Son's specification. They are on the Isherwood principle. They are reported to have secured the contract for three cargo steamers, ranging from 7,200 to 9,000 tons deadweight, to the order of Messrs. Houlder Bros., Liverpool, on behalf of the Empire Transport Co., Ltd.; also two steamers for Messrs. Brunsgaard, of Drammen, of 7,000 tons deadweight, with machinery supplied by Messrs. The North-Eastern Marine Engineering Co., Sunderland.

Messrs. W. Harkess & Son are busy with work on hand, and expect to secure the order for a small steamer that is in the market.

Messrs. Smith's Dry Dock Co. at South Bank recently launched six finely-modelled steel screw drifters on one day, which is believed to be a record performance. They have just had the P. & O. steamer *Candia* in dry dock, and expect shortly to have the s.s. *Chyebassa* in for overhauling, besides having plenty of new work.

Messrs. Richardsons, Westgarth & Co., Ltd., are reported to have secured the order for three sets of marine engines and boilers for boats to be built locally and are also very busy with other marine and land engine work.

Stockton and Thornaby.

Messrs. Robert Ropner & Sons are very busy with work on hand, but nothing new is reported, prices still remain very low.

Messrs. Craig, Taylor & Co. are well supplied with work and busy with the boats recently secured to build.

Messrs. Blair & Co. are now fairly busy, and are reported to have secured contracts to supply two sets of machinery for cargo steamers building on the Tees.

Messrs. Richardson, Duck & Co. are expecting an order shortly, and continue busy with work on hand, nearly all of which is on the Isherwood principle.

West Hartlepool.

Messrs. Wm. Gray & Co. have booked the contract to build a medium-sized cargo steamer to the order of Messrs. J. Murrell & Sons, also a smaller steamer reported to be for Messrs. Olsen & Co., also of West Hartlepool. This firm is very busy, being well booked up into the middle of next year.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Harbour Yard, have just launched the s.s. *Stephen Furness* for the Tyne Tees Steamship Co., which is a beautiful boat and does the firm much credit. They have also secured the contract for a small cargo steamer to replace the s.s. *Lamorna*, recently sold to foreigners and rechristened the s.s. *Graanhandel*. They have also undertaken the salvage work in connection with the Glasgow steamer s.s. *Hermiston*, which stranded near Robin Hood's Bay during a dense fog. She is in a very bad position, and is making water in all her holds.

The Central Marine Engine Works have secured the contracts for two sets of machinery for the cargo steamers to be built by Messrs. Wm. Gray & Co. They are now very busy in all departments.

Hartlepool.

Messrs. Furness, Withy & Co. have just sold the s.s. *Acacia* reported to be to foreigners, and Messrs. W. Forslind & Son have sold the s.s. *Dalarne* to Messrs. Simpson, Metcalfe and Co. for about £13,000 for a Scandinavian firm, and the latter is likely to be renamed the s.s. *Moldavia*.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Middleton, have secured a contract to build a large cargo steamer, a repeat of two others building to the order of Sir Christopher Furness. They are reported to have secured the contract for two steamers out of ten that are being placed by Messrs. Houlder Bros. on behalf of the Empire Transport Co., Ltd. They have also a very important repair contract for work to the s.s. *Manchester Spinner*. She has her bottom amidships knocked up over 4 inches, the engines being practically demolished, all the main castings being broken. The hull has had to be entirely suspended by shores to enable the extensive repair necessary to the body of the ship.

Messrs. Richardsons, Westgarth & Co., Ltd., have secured the contract to supply the machinery for the steamer recently booked by the Irvine Shipbuilding & Dry Dock Co. of about 1,800 I.H.P. They also have several important contracts, one of which is to supply four evaporators of 180 tons each for a French firm. They are very busy in their speciality department.

The s.s. *London City* has been sold to the Cadeby & Denaby Colliery Co., Ltd., and is being fitted out as a coaling steamer with large transport conveyors.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

Distinguished Honour for a Hull Captain.—After thirty-eight years' service with the Wilson Line, Captain George Pepper has just retired, the occasion being marked in a signal manner by the King of Norway, who has conferred on Captain Pepper the Order of St. Olaf, the most distinguished decoration possible for him to bestow. The decoration was handed to Captain Pepper by M. I. Irgens, Norwegian Minister for Foreign Affairs, and but for the death of His Majesty King Edward VII., the Order would have been presented personally by His Majesty King Haakon of Norway. Accompanying the decoration is an Address from the citizens of Christiania, beautifully illuminated with Norwegian design, headed with the British and Norwegian flags, and the Wilson Line pennant, and a representation of the R.M.S. *Oslo*, while at the foot a facsimile of the Order is worked into the design. The Captain has also received chased silver bowls of beautiful design from Messrs. R. Heitmann, the agents at Christiania, and Messrs. F. Reinhardt & Co., of Christiansund. During his career Captain Pepper has commanded the *Tasso*, *Argo*, *Angelo*, *Hero*, *Juno*, *Rollo*, *Montebello*, and completed his last voyage in the steamer *Oslo*. Though he has crossed the North Sea 1812 times, and travelled about 1,034,748 miles, carrying approximately 160,000 passengers, he has not lost a single passenger. He possesses many interesting trophies of Arctic and Antarctic exploration, and supervised the construction of the sledges for Lieutenant Shackleton's and Captain Scott's expeditions. Sir Ernest Shackleton paid a tribute to Captain Pepper's

assistance in his book, whilst Captain Scott has written to him expressing his delight with the sledges which were prepared under the superintendence of Captain Pepper. The Captain is a Younger Brother of the Trinity House, the Secretary of the Hull Mariners' Church and Sailors' Rescue Society, also a member of the Committee of the Spring Bank Orphanage, an institution in which he takes great interest. He was born in Hull, September 1847, and is therefore sixty-two years of age. The writer has sailed under Captain Pepper as Chief Engineer of R.M.S. *Rollo*.

New Port of Immingham, between Grimsby and Hull.—Notices have been sent to shippers and ship-brokers at Grimsby that the coal shipments would begin at the new Port of Immingham in June. The dock itself will not be completed for some months, but the piers flanking the dock approaches are nearing completion, and as they are equipped with coal hoists vessels will be able to replenish bunkers or take in coal cargoes from them without utilising the dock proper. A scale of charges and dock dues have been drawn up and issued to shippers by the dock company. The Port of Hull need have no fear of this new dock as regards competition, the North-Eastern, Hull & Barnsley Railways, and Dock Companies are pushing ahead with their new deep-water dock situated to the south side of the Alexandra Docks.

Wireless Telegraphy on Hull Ships.—Messrs. Thos. Wilson, Sons & Co. (Ltd.), of Hull, have completed contracts for the installation of wireless telegraphy in their steamers *Buffalo*, *Idaho* and *Galileo* in the New York service, and the R.M.S. *Calypso*, *Ariosto* and *Montebello* in the Gothenburg (Sweden) service. The system used will be that of the United Wireless Telegraph Co., of New York, which during the past month has been adopted on forty-six steamers.

New Wilson Liner.—A steel screw cargo-steamer with a deadweight carrying capacity of about 8,850 tons, at present building by the Northumberland Shipbuilding Company, Howdon, and now ready for delivery, has been sold to Thomas Wilson, Sons & Co., Ltd., Hull.

Messrs. Earle's Shipbuilding and Engineering Co., Ltd. are very busy fitting out and preparing the R.M.S. *Eskimo* for her trials under steam. When same is finished, the owners—the Wilson Line—will place her in commission, to run between Hull and Christiania. The passenger season is just opening up, and this particular steamer is well fitted to carry first and second-class passengers and emigrants. The second steamer of four ordered for the Great Central Railway Co., has just been launched, and is fitting out for the Continental trades. These vessels are expected to have a good speed, and will be well equipped for carrying first and second-class passengers and emigrants, and good cargo space. The London, Brighton & South Coast Railway Co.'s steamer has been launched and is fitting out for steam trials. The H.M.S. paddle tug is preparing for trials. The works are fairly busy with other steamers building, and repair work on steamers in their mud docks and patent slips. The firm has about 3,000 men at work daily.

Messrs. Cochrane & Sons, Shipbuilders, Selby.—This yard is situated on the upper reaches of the Humber, and is busy building trawlers and steam drifters for Grimsby and Hull owners.

Messrs. Cook, Welton & Gemmell, Shipbuilders, Beverley, have secured the contracts to build several trawlers for Grimsby and Hull.

Messrs. Amos & Smith, Engineers and Boilermakers, have secured the machinery and boilers for several trawlers building in the district. They are building engines for a Wilson liner, and keeping fairly busy with repair work. Their branch works, situated at Alexandra Dock, have plenty of repair work, and steamers owned by the Wilson Line and others are being dry-docked.

Messrs. Cooper & Co., Ltd., Engineers and Boilermakers, are fairly busy at their main works at Neptune Street on repair work, etc. The moulding shop is full of orders for propellers, for Home and Foreign Companies. The dry docks are busy, and well booked forward, and the branch shop situated at Alexandra Dock busy with repair work and dry-docking of several large steamers.

Messrs. C. D. Holmes & Co., Ltd., Engineers and Boilermakers, have secured several sets of engines and boilers, building for local owners. The works at Alfred Street are fairly busy with general repair work, and the branch shop at Alexandra Dock is kept busy with repairs and dry docking of steamers.

Messrs. Woodall & Co., Engineers and Boilermakers, have been fairly busy with engine-room and deck repairs on a number of steamers trading to this port, on several docks around the port, also overhauling machinery in the Tramway Electrical Department of the Hull Corporation. They have finished and delivered several orders for their patent purchase blocks to the Companea Euskalduna Bilboa. The orders booked for their blocks will keep them fully occupied for next few months.

Humber Iron Works have been fairly busy with the following steamers on their patent slip:—s.s. *Fairy*, s.s. *Sea Nymph*, s.s. *Winifred*, s.s. *Enid*, s.s. *Alice*, s.s. *Edith*, changing propellers and drawing shafts, engine-room and stoke-hold repairs, also deck repairs, painting hulls, etc. The engine and smith's and boiler shops are kept fairly busy with repair and new work.

North-East Coast Engineering Works.—This new Company is still forging ahead. They have been busy with the following:—s.s. *Beira*, Bucknall liner, also s.s. *Polarstjernan*, s.s. *Prudentia*, s.t. *Powerful* and s.t. *Englishman*, the last named, disconnecting the cylinders, rejointing the same and overhauling machinery. The other mentioned steamers have had engine and deck repairs. They have also secured the contract for erecting six mortar mills. Two of the mills have been finished, weight 20 tons nett, and have been despatched to Santa Rosalia, Mexico.

Hull Central Dry Docks and Engineering Works.—This firm at all times seem to be to the front as regards dry-docking and repair work and putting steamers through for Lloyd's general surveys. They have docked the following steamers: s.s. *Lisette*, s.s. *Ethelwynne*, s.s. *Unity*, s.s. *Mersey*, s.s. *Dearne*, s.s. *Wharfe*, s.s. *Mellefont*, and s.s. *Ralph Creyke*, the last six steamers owned by the L. & Y. Railway Co., s.s. *Largo Law*, s.s. *Bessborough* and s.s. *Bard*, the s.s. *Ralph Creyke* now in dry-dock, when going to press, with stern frames and rudder repairs, and general engine-room and deck repairs.

Coal Report for Hull for the month of April is as follows:—

Total entry, April, 1910	598,624	tons.
,, ,, ,, 1909	413,334	,,
Increase	185,280	,,
,, ,, River	47,368	,,
,, ,, Rail	551,256	,,
,, ,, during current year	2,070,608	,,
,, ,, ,, 1909	1,586,688	,,
Increase	483,920	,,
London and Coast export, current year	340,179	,,
,, ,, ,, 1909	270,395	,,
Increase	69,784	,,

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

THE question of dredging the harbour entrance to a depth of 35 feet came up for consideration at the Harbour Board's meeting on the 24th of last month, but we were unable to announce the result of their deliberations before going to press. It is, however, confidently anticipated that as a result of this meeting tenders would be asked for the additional dredging. The London & South-Western Railway Co. have already agreed to pay half the cost of the dredging at Thorn Knoll.

The Atlantic Transport Co.'s steamer *Minnehaha* sailed from Southampton on the 26th of March last, and on her return voyage, as is well known, stranded on the rocks off the Scilly Isles, sustaining very extensive damage, and at one time very little hope of salving the vessel was entertained. The salvage operations were, however, successful, and the vessel was safely beached on the Woolston Shore at this port on the 21st of last month, where pumping operations were in progress previous to the vessel docking in the Trafalgar dry dock, where the work of repair will be carried out by Messrs. Harland & Wolff. It will be remembered

that the London & South-Western Railway Co. have definitely decided to increase the width of this dock in order that the *Olympic* and *Titanic* could be more easily accommodated, and in view of this decision it was feared that the work could not possibly be executed at this port. The salving of this vessel from her dangerous position will rank as one of the most brilliant feats in salvage operations. The *Minnehaha* is a twin-screw vessel of 13,440 tons and was built by Messrs. Harland & Wolff in 1900. She is 600 ft. long by 65·5 ft. wide and 39·5 ft. deep.

The Union Castle Co.—The latest addition to the Company's fleet, the *Edinburgh Castle*, was open for public inspection on Whit Monday, and upwards of 1,000 persons availed themselves of the opportunity to inspect the ship. The proceeds were distributed among local charities. The vessel sailed in the Company's mail service on her maiden voyage on the 21st of last month. She has been built and engined by Messrs. Harland & Wolff, and has accommodation for 320 first, 220 second, and 250 third-class passengers. The same Company's *Balmoral Castle* finished her maiden voyage to the Cape on the same day. This vessel was to have conveyed the King, as Prince of Wales, to open the first South African Parliament in the autumn, but of course this visit has now been abandoned.

As a consequence of the working arrangement between the London & South-Western Railway Co. and the Great Western Railway Co., the former Company will, after the 28th of this month, withdraw from the ocean passenger traffic at Plymouth. The Great Western Railway Co. will disembark passengers at Millbay Dock and the London and South-Western Railway Co.'s tender will return to this port.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works.—H.M.S. *Savage*. This torpedo-boat destroyer ran her official trials last month. H.M. ships *Larne*, *Lyra*, *Martin* and *Minstrel*.—Work on these vessels is advancing rapidly, and several of the compartments in the first two vessels have been satisfactorily water-tested. New fire float.—A start has been made on the construction of this vessel, and the frame turning was completed last month. An order was received last month for an 80-ft. stern-wheel steamer, fitted with saw mill machinery for service on the river Amazon. Several of the motor boats under construction will run their trials this month. The 56-ft. twin-screw shallow-draught motor launch *Tungku Miriam* concluded her trials last month, with very satisfactory results. The Repairs Department were very busy last month, the following vessels being under repair:—H.M. ships *Halcyon* and *Volcano*, s.s. *Alchymist*, and steam yachts *Capercailzie*, *Rainbow*, *Liberty* and *Algol*.

Messrs. J. Samuel White & Co., Ltd., East Cowes, I. of W.—H.M.S. torpedo-boat destroyer *Harpy*, one of the 27-knot ocean going destroyers, completed her speed, coal consumption and other trials last month with very satisfactory results, and will shortly be handed over to the Admiralty. An equipment of steamboats, comprising two 50-ft. pinnaces, one 56-ft. launch, and one 32-ft. cutter, were delivered to Barrow last month, for the Brazilian battleship *Sao Paulo*.

THAMES.

(From our Own Correspondent.)

Port of London Rates.—Viscount St. Aldwyn's report to the Board of Trade has been issued with respect to the schedule of maximum rates to be levied by the Port of London Authority. It will be sufficient if we indicate briefly the principal changes introduced during the inquiry. Oversea imports were estimated by the authority to produce £550,000 a year and £200,000 from exports as a maximum, and the only available figures on coastwise traffic is that of a 1d. per ton rate on coal which it is estimated will produce £35,000, to which there will be exemption. The report gives it that some of these rates are unnecessarily high and reductions are made in the schedule. As regards the *ad valorem* rates urged by some objectors, this was not supported, and in many cases the rates on articles of low value were reduced to prevent the articles being driven from the market. The report goes on to say that the Authority must be considered to be guarding the interests of the Port, and the Board of Trade is not to be a Court of Appeal against the rates actually charged or other administrative action taken by the Authority, but in view of the large demand there was for some sort of protection the following directions were given, which the Authority should endeavour to stand by, *viz*:—(1) The import rates on the materials used in the manufacture of any article shall not be more than the import rates on a like manufactured article imported from over the sea, and (2) the port rates actually charged on goods exported beyond the seas shall not exceed one-half of the port rates for the time being actually charged on similar goods imported from beyond the seas. For imported goods re-exported there was no rebate in any case, and it is left to the Authority to redress any hardship which may arise. As to the short sea traders' complaint of the competition by the through rates of the railway companies, the report has again left it to the Authority to deal with any special case of hardship, which the railway companies are not amenable to directly. As to the rates on coal and similar articles of 6d. per ton, it is argued in the report that the sea-borne coal trade is a prosperous one and can well afford a moderate rate such as the one proposed, but that as the coastwise traffic is to be only one-half the maximum this would reduce it to 3d. a ton, but there has been inserted a clause making the rate 2d. a ton, the exemption of bunker coal being extended by a new clause.

New Shipbuilding.—It is understood that the sixth Orient boat has been ordered from Messrs. John Brown & Co., of Clydebank, the builders of the *Orsova*. The *Edinburgh Castle*, of the Union Castle Line, was due to sail from Southampton on the 21st May. As well as the *Balmoral Castle*, she exceeds 13,300 gross tons, and built by Messrs. Harland and Wolff, has accommodation for 320 first-class, 120 second-class and 250 third-class passengers. The twin screws are driven by quadruple-expansion engines, and both vessels are provided with wireless telegraph apparatus.

River Craft Legislation.—A bill has been presented to Parliament for the Board of Trade by Mr. Tennant, in which the fees payable for registration by a steam tug are £6, a lighter or barge 1s. per ton, steam barge £2 and 1s. per ton, canal barge £1, canal boat 7s. 6d., and minor registration fees, the bill being read a first time.

Shipping Report.—The Shaw, Savill & Albion Co.'s report shows a profit of £35,133 on the year's working, carrying £10,000 to renewal fund and £25,000 to insurance, and making provision for depreciation. A dividend of 5 per cent. on the "A" shares and 5 per cent. on the "B" shares has been paid.

Nautical Almanac Office.—The new superintendent is Mr. P. H. Cowell, M.A., F.R.S., who was until recently a chief assistant at the Royal Observatory, Greenwich. This gentleman's name is known in connection with computations of the orbit of Halley's comet. He has been besides answerable for calculations respecting the motion of the moon.

Thames Conservancy Report.—In view of the changed conditions and the division of the river it is found that the revenue of this body is not sufficient to meet possible charges in the future and enable the Conservancy to exercise its borrowing powers. A provisional order is being applied for to increase the tolls, fees and other charges, but even then capital expenditure to any extent will not be provided for.

The South Pole Expedition.—The *Terra Nova* was due to leave London on the 1st of June, and after calling at Portsmouth and Cardiff will finally leave the latter port on the 15th of this month. The stores were practically all taken on board in London, the coal being finally shipped at Cardiff for the voyage out.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

Messrs. Cammell, Laird & Co.—All the extensive facilities of this well-known establishment continue to be well employed both for new construction and repair work, and the range of work in hand is, as usual, in keeping with the firm's traditions. The floating dock is now well in hand, the machinery for H.M.S. *Blonde* is being rapidly pushed forward and will shortly be shipped to Pembroke. The *Wolverine*, the second destroyer of the *Beagle* class, is now

undergoing her trials. The Isle of Man steamer *Snaefell* has passed through basin trials and will shortly run her official trial. This boat has a very smart appearance combined with comfort and thorough sea-going qualities for both summer and winter traffic. It is understood that the whole of the steam and exhaust pipes, etc., are being covered with a new and highly efficient speciality now being very successfully installed by Messrs. Johns & Walker, of Liverpool. The London and South-Western Railway Co.'s two steamers are well in hand, and will be launched very shortly. These boats will be complete in every detail for the comfort and safety of the passengers. The Welin davits are being fitted throughout, thus enabling the boats to be swung out under any possible conditions. An order has been recently booked for a small single-screw steamer for South American owners through Messrs. Singlehurst to the design of Messrs. Roscoe and Little, consulting naval architects, who will supervise the construction. The vessel will be about 130 ft. by 24 ft. by 7 ft. 6 in. deep, aud will have a speed of about 10 knots at light draught. A second order has been received for a steel poling canoe for Messrs. J. Holt, of Liverpool, the work on the first being now well advanced. The framing has been started on the first Argentine destroyer and will be completed before the end of June. Work on the machinery and boilers is well in hand. Work in the repair department continues to be plentiful, several of the Isle of Man Co.'s steamers, also *La Marguerite* having recently left dock. The steamer *Ardgrffyi* has undergone repairs, also the sailing ship *Dalrymple*. The steamer *Ruth* has been in dry dock and had general overhaul. The *St. Elvies* has had her spring beam repaired, which was damaged at Llandudno during Whitsuntide. The steamer *New Orleans* having been ashore in the Straits Settlements, has been sold in her damaged condition and after temporary repairs will discharge her cargo and come to Liverpool for extensive repairs. The steamer *Wavetree*, owned by Messrs. Wellsford, of Liverpool, has been sold to Australian owners for use on the coast of South America.

Messrs. H. & C. Grayson.—This firm have had every section of their various yards occupied with important work. The *Largiemore* sailing ship, besides extensive repairs, has had masts and rigging renewed. The oil steamer *Delaware*, owned by the Anglo-American Oil Co., and the Glasgow steamer *Suduna* have had overhaul and repairs, also the steamer *Tabusco*, *John Hugo* and *Robert Elsie*. The chief feature of the month with Messrs. Grayson has been the docking and painting, etc., of the Brazilian battleship *Sao Paulo* in the Canada Dry Dock, which was placed at their disposal by the Mersey Docks and Harbour Board. This huge vessel was successfully docked and the bottom recoated with "Red Hand Brand" composition. Great care was taken in supporting such a great weight, the operations being superintended personally by Messrs. Grayson. The *Sao Paulo* is the third of the "Dreadnought" type of battleship ordered in this country by the Brazilian Government. Her length is 500 ft. between perpendiculars, 543 ft. overall, 84 ft. beam, displacement 19,000 tons. She may be the last battleship to have reciprocating engines; these will develop 21,000 i.h.p. with a speed of 21 knots. The boilers are arranged to burn both coal and oil. The cost of the vessel is said to be about £2,000,000. The first vessel of the type, the *Minas Geraes*, has arrived in Rio de Janeiro, the keel of the third was laid early this year and will be called the *Rio de Janeiro*, the two latter being built by Messrs. Armstrong, Whitworth and Co. Other repairs by this firm include the steamers *Cornish Coast*, *Belle Ailsa* and *New Orleans*. Orders for several pontoons have been secured for shipment abroad.

Messrs. Clover, Clayton & Co.—This firm have had their hands full with general repairs and surveys, some of which have been of much special interest. The Liverpool coasting steamer *Skelwith Force* and the steamer *Gisla* have been in for general repairs. The barge *Luke Bruce* has had a general overhaul. This vessel as a barque traded some years ago in the Mersey West African trade, but is now ending her days as a coal barge. The tug *Blazer* has been in for inspection. This tug, together with the *Pathfinder*, successfully towed the new fore end of the *Suevic* from Belfast to Southampton some time ago.

The Liverpool Engineering and Condenser Co. This firm have a lot of work in hand at present, including the distilling plant for H.M.S. cruiser *Weymouth*. This firm are now fitting their patent dripless condenser to nine steamers for the Nelson Line.

Liverpool Salvage Association.—Another fine piece of work has been brought to a successful issue under the supervision of the chief officer of this Company, Captain F. M. Young. The *Minnehaha*, which stranded on the Scilly Isles, has been floated under her own steam. The cargo was removed out of the forward hold and that in the aft holds will be taken on to its destination. Heavy swells and rough weather had to be guarded against during the salvage operations. This is one of the finest salvage feats of recent years, second only to H.M.S. *Gladiator*, undertaken by the same Company.

The Liverpool Patents Co.—The Trident patent firebars made by this Company have been fitted to no less than 350 steamers during twenty months, which speaks well for their special qualities.

Canadian Pacific Railway Co.—Several important changes have taken place in the *personnel* of this Company's staff recently, the most important being the appointment of Mr. F. W. Forster as head Liverpool agent. Mr. Forster entered the employ of the late Sir Alfred Jones in 1897, and in 1900 was appointed manager of Messrs. Elder, Dempster's Bristol business, where he inaugurated the Imperial Direct West Indian service from that port. Mr. Forster joined the C.P.R. in 1903 when that Company took over the late Sir Alfred Jones' Canadian services. Captain Forster, a brother, is the popular commander of the *Empress of Britain*.

Cunard Steamship Co.—At the recent annual meeting of this Company the chairman, Mr. A. A. Booth, intimated that while there was no dividend the revenues would benefit to the extent of £80,000, and that next year they hoped to pay and continue to pay a small dividend. As a sequel to this may be taken the recent placing of an order for another special type of Atlantic liner with Messrs. Swan, Hunter & Wigham Richardson, of Newcastle. She will be 18,000 tons, 600 ft. long and 70 ft. beam, and primarily with her sister ship the *Franconia* will be placed on the Liverpool and Boston route. The *Ivernia* and *Saxonia* being transferred to the New York Mediterranean service. While the passenger business to U.S.A. ports has increased freight cargoes have dwindled. These new steamers will meet the situation, for they will have large cargo space, combined with the highest class passenger accommodation and an accelerated rate of propulsion. It is rumoured that this Company will, in the near future, build similarly adapted steamers for the New York trade, greater in size than the *Mauretania* and *Lusitania*. The *Umbria* is now beached at Bridgeness and is being broken up.

White Star Line.—The accounts of this Company to Dec. 31st were recently presented and show a profit for the year of £620,344. A dividend of 10 per cent. and bonus was declared. The Canadian service was inaugurated in April 1909, with the *Laurentic* and *Megantic*, and has established itself in popular favour.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Messrs. Vickers, Sons & Maxim.—There has not been any important development in connection with Messrs. Vickers' during May beyond the departure of the Brazilian battleship *Sao Paulo* on her trials. The construction works are getting very busy, especially in the engineering departments and the rush of work is likely to continue for some considerable time. The second-class cruiser *Liverpool* has been dry docked at Barrow and in the middle of June will be leaving for her trials. There has really been very little said as to the speed which it is anticipated this vessel will attain, but there is every reason to expect some startling figures. The *Liverpool* is the only vessel which is now completing at the wharves, and it will be some time before another ship is launched and brought round. There have been several repair and overhauling jobs dealt with, but none of them have been of any importance. The keel of the vessel similar to the *Liverpool*, the *Dartmouth*, will shortly be laid, and her construction will be proceeded with quickly.

The "Sao Paulo."—No battleship ever built at Barrow has presented such a fine sight as did the Brazilian battleship

when she left the port for Liverpool. Painted white, the sun striking her at the right angle, she looked a picture. She was taken out in rather rough weather, but she was handled cleverly and subsequently was docked in the Canada dry dock at Liverpool, where she was overhauled and painted. She left there towards the end of the month and proceeded to Greenock where she coaled. At the time of writing preparations were being made to take her out on the measured mile for trials. These completed she will proceed into the Irish Sea to undergo gun trials. It is understood that one of the tests will be the firing of all the twelve 12-in. guns at the same time, a test which I believe is unique. The builders are confident that she will pass through all her trials with ease. There never appears to be any difficulty with any of Vickers' vessels with regard to trials, those of the *Vanguard* for instance, and a more remarkable success still, the propelling machinery of H.M.S. *Magnificent*. The latter was a record never before or since equalled.

The "Princess Royal."—The keel of the battleship-cruiser was laid on May 2nd in the early hours of the morning. There was practically no ceremony, no flags were flying, and there was no general holiday. One of the officials of the yard, in speaking of the unofficial event, jocularly remarked that the keel laying time was not the period to put flags out and cheer. When the vessel was the right side of her trials two years or less from now was the time. There is probably something in this, and there is not the slightest doubt that Messrs. Vickers are going to concentrate their enormous staff and works upon the two 70,000 horse power sets for the *Princess Royal* and the sister ship the *Lion*, and the hull, guns, etc. of the former, and are out for record breaking. The organization is magnificent, nothing is being left to chance; every department has its work to do in stated periods and the result, as anticipated, will give the shipbuilding world something to think about. It will be a fitting reply to some of the American remarks which have been noticeable in the American press, prompted by the securing of the Argentine contracts in that country.

Brazilian Floating Dock.—This huge dock is now nearing completion, and will probably be launched during June. It will take three days to launch this dock. A section will be launched each day, and they will be towed a slight distance along the channel alongside a wharf to be fitted and completed. This dock has to be delivered by September, and the towage of such a huge affair is no small item. According to certain rumours, Messrs. Vickers—who are nothing if not original—are building a powerful tug to take the dock out. It is supposed when the tug has completed her task she will be put on the market and there will be a good tug for somebody. It will be remembered that Messrs. Vickers built a vessel to convey the two Japanese submarines to Japan. Since then the transporter has been altered and sold to an Italian firm.

New Steamer for the Furness Railway Co.—The Furness Railway Co. has for some time badly needed a new vessel for the Barrow and Fleetwood service, and they have eventually been successful in purchasing the steamer *Gwalia* from the Barry Railway Co. This vessel is only beginning her fifth season and should prove of great use on her new service. She is a paddle steamer some 245 ft. long, is splendidly appointed, and has a speed approaching 19 knots. She was built by Messrs. John Brown, of Clydebank. Her engines are of the compound type with h.p. cylinder $34\frac{1}{2}$ in., b.p. cylinder 71 in., and a stroke of 60 in. During Whitsun-week she was put on the service and proved herself a most capable vessel. She is now in dock again for overhauling and painting, and when she goes on to the station again she will be known as the *Lady Moyra*. She is to be named after Lady Richard Cavendish, whose husband is a director of the Furness Railway Co., and who is brother to the chairman, the Duke of Devonshire.

BELFAST.

(From our Own Correspondent.)

Messrs. Harland & Wolff.—Since the departure of the Union-Castle liner *Edinburgh Castle*, on 27th April, Messrs. Harland & Wolff have been without any new tonnage in the water, but they will shortly launch from the south end of their yard a twin-screw vessel of big dimensions for the Shaw, Savill & Albion Co. The *Edinburgh Castle* is a magnificent twin-screw vessel 585 ft. long by 64 ft. 8 in. beam, with a gross tonnage of about 13,460 tons and 12,590 i.h.p. A full description of the vessel appeared in the March issue of the "Marine Engineer." Messrs. Harland & Wolff have secured the order for one of three intermediate vessels for the Union-Castle Co., the other two, it is stated, to be built by Fairfield and Messrs. Barclay, Curle & Co. It was expected that the Atlantic Transport Co.'s *Minnehaha*, which was recently ashore on the Scilly Islands, would be brought to the Queen's Island for repairs; but since a further examination of the vessel has been made at Falmouth, it is doubtful if it will be considered safe to take the vessel so far in her damaged condition. It is probable, therefore, that she will go to Southampton, where she will be docked and repaired at the firm's branch works there. One of the most attractive models at the Japan-British Exhibition, recently opened in London, is a twenty-foot model of the White Star liner *Olympic*. The model is a complete replica of this leviathan, and through the ports can be seen the saloons and state-rooms all fitted up and decorated as they will be when the vessel is finished for sea. Even electric light has been installed in the model.

Messrs. Workman, Clark & Co.—This firm has launched two vessels since last month's notes were penned—the *St. Albans* for the Eastern and Australian Steamship Co., and the *Muritai* for the Tyser Line. The latter is the sixth vessel constructed by Messrs. Workman, Clark & Co. for this well-known fleet. The latest addition is a fine twin-screw steamer 486 ft. long, with a gross tonnage of about 7300. She has been specially designed for the frozen meat trade between Australia and this country, and accommodation for a limited number of passengers has been fitted up amidships. The former vessel is 381 ft. in length and about 4500 gross tonnage. She has been built to carry cargo and passengers between Australian and Chinese ports. The propelling machinery is a set of triple-expansion engines, steam being supplied by four single-ended boilers.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Sir Ernest Cassel.—On April 23rd, an ore-carrying vessel of special type, named *Sir Ernest Cassel*, was launched by Messrs. R. & W. Hawthorn, Leslie & Co., Ltd. She is being built to take the highest class of the British Corporation, and has a length of 458 ft. overall, breadth 60 ft., depth 34 ft., and will carry a deadweight cargo of 11,000 tons. The special features in her construction consist of twelve gravity discharge ore pockets of the Johnson-Welin patent type instead of the usual holds. Between these pockets discharge compartments are arranged in which are placed the chutes delivering the ore by gravity in iron skips. The discharge compartments extend from the deck to the bottom of the ship, and there are twelve powerful electric cranes on deck which enable the skips to be worked almost continuously. The vessel will be fitted with machinery constructed by the North-Eastern Marine Engineering Co., Ltd., which will enable her to steam at a speed of $10\frac{1}{2}$ knots. This machinery will consist of a set of triple-expansion engines with cylinders 27 in., 45 in., 74 in. by 54 in. stroke, the steam being supplied by three large single-ended boilers.

Neptun.—On April 25th, Messrs. Robert Thompson and Sons, Ltd., launched from their Southwick Yard a finely modelled steel screw steamer of the partial awning-deck type, built for Messrs. The Dampfschifffahrts-Gesellschaft "Neptun" of Bremen. The principal dimensions of the vessel are:—Length, B.P., 225 ft.; breadth extreme, 35 ft.; depth moulded, 15 ft. 6 in., and she will be classed 100 A1 at Lloyd's. Water ballast is provided in the cellular bottom and after peak. The engineers' and officers' berths are placed in houses alongside the engine casing, and the crew's quarters forward, the floors under all accommodation being laid with Litosilo. There are four cargo hatches, each worked by a steam winch for rapid loading and discharging, and a multi-tubular donkey boiler of ample capacity, also steam windlass and steam and hand-steering gear. The engines are of the triple-expansion type by Messrs. McColl & Pollock, Ltd.,

having cylinders 17 in., 28½ in. and 46 in., with a stroke of 33 in., steam being supplied by an extra large boiler working at a pressure of 180 lbs. per square inch.

Harpagus.—On April 25th, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Harpagus*, which they have built to the order of Messrs. J. & C. Harrison, Ltd., London. She will take the highest class in Lloyd's, and is of the following dimensions, *viz.*: —Length overall, 441 ft.; breadth, 53 ft. 6 in., and depth, 31 ft. 8 in., with two decks laid, extra long bridge, poop and topgallant forecastle. The hull is built with deep frames, clear holds, cellular double bottom and large aft and fore-peak ballast tanks, ten steam winches, return exhaust and winch condenser, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, shifting boards, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead, ventilation sufficient for the Eastern trade, electric light throughout, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 28 in., 45 in. and 75 in., with a piston stroke of 51 in., and four large steel boilers adapted for a pressure of 180 lbs. per square inch, worked by Howden's system of forced draught, bronze propeller, etc. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the engine-room tank, engine casing, deck under sanitary tanks, also bunkers and their "Bitumastic" covering to galley top, tank tops in engine and boiler rooms.

British Transport.—On April 25th, Sir Raylton Dixon and Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, the fine steel screw steamer *British Transport*, being constructed to the order of the Empire Transport Co., Ltd., of London. The vessel will be classed 100 A1 at Lloyd's, her principal dimensions being 377 ft. 6 in. by 51 ft. 2 in. by 28 ft. 4½ in., moulded, and she will have a deadweight carrying capacity of about 7,200 tons on a light draught of water.

Carthage.—On April 25th, the mail and passenger steamer *Carthage* was launched from the Neptune Works, Newcastle-on-Tyne, of Messrs. Swan, Hunter & Wigham Richardson, Ltd. The vessel is being built for the Cie. Générale Transatlantique of Paris, and is intended for their service between Marseilles and Algeria. She is a handsomely modelled steel twin-screw steamer over 400 ft. in length by over 51 ft. beam, propelled by two sets of four-crank triple-expansion engines, on the well-known Yarrow, Schlick & Tweedy system, supplied by eight single-ended boilers fitted with Howden's system of forced draught. The speed of the vessel will be 19 knots. The passenger accommodation is of the most luxurious description. The first-class passengers' staterooms, including *de luxe* rooms, for 170 passengers in all are situated amidships. The second-class passengers, ninety-four in number, are accommodated aft, and the third-class, seventy in number, are berthed forward. The vessel will be rigged as a two-masted schooner, and the equipment of machinery for manœuvring her, handling cargo, etc., will include eight electric winches in addition to the usual steam-steering gear, controlled by telemotor, capstans, windlass, etc. She is also to be fitted with an installation of wireless telegraphy. Electricity is largely used on board, not only for lighting the vessel throughout, but also for ventilating the various rooms by means of fans, for extra heating of some of the most elaborate rooms by electric fires, and for working some of the deck machinery. There is also steam heating throughout.

Seawall.—On April 26th, Messrs. Richardson, Duck and Co. launched from their yard a steel screw steamer of the following dimensions:—Length overall, 336 ft.; breadth, extreme, 47 ft; depth moulded, 24 ft. 10 in., gross tonnage, about 3,050. This vessel, which has been built to the order of The Mawson Shipping Co., Ltd., Cardiff (Messrs. Arthur Mawson & Co., managers), will class 100 A1 in Lloyd's register, and has been built under special survey. She is a single-deck steamer, having cargo poop, long bridge extending from mainmast to foremast, and topgallant forecastle. A cellular double bottom for water ballast is fitted throughout, except under boilers. The vessel has also an after-peak tank, and equipment includes steam windlass with quick-warping ends, stockless anchors, six steam winches, large horizontal multitubular donkey boiler, eleven derricks, etc. The engines by Messrs. Blair & Co., Ltd., have cylinders 23½ in., 39 in., 64 in. by 42 in. stroke, steam being supplied by two single-ended boilers having a working pressure of 180 lbs. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the bunkers, and their "Bitumastic" covering to the tank top under boilers.

Atland.—On April 28th, there was launched from the yard of Messrs. Wm. Doxford & Sons, Ltd., Sunderland, a turret-deck steamer 390 ft. long, 52½ ft. beam, carrying 8,000 tons deadweight on 24 ft. The vessel is especially designed for general trades with a view to special work in iron ore in addition, and is fitted with tri-compound engines, also made by the builders, to give a speed of 11 knots. The vessel is to the order of Dan Broström, Esq., Gothenburg, and is built to British Corporation classification, with special arrangement of scantlings and special water ballast arrangements.

Norhilda.—On May 6th, Messrs. Swan, Hunter & Wigham Richardson, Ltd., launched the steamer *Norhilda*, which they are building at their Neptune Works, Newcastle-on-Tyne, for the Donald Steamship Co., Ltd., of Bristol and New York. She is 230 ft. in length by 36½ ft. beam, and is constructed of steel on the deep-frame principle to attain the highest class in Lloyd's Regsiter. Being intended for trade on the North Atlantic coast of North America, she is specially strengthened for ice. The steamer is intended to carry about 2,000 tons deadweight on a mean draught of 16 ft. The appliances for working the cargo and manœuvring the vessel are of the most ample and up-to-date type. The propelling machinery will consist of a set of triple-expansion engines, which, together with the boilers, are being manufactured by the North-Eastern Marine Engineering Co., Ltd., Wallsend.

Remembrance.—On May 9th, Messrs. Robert Thompson and Sons, Ltd., launched from their Southwick Yard a first-class cargo steamer, built to the order of Messrs. The Freear and Dix Steam Shipping Co., Ltd., Sunderland. The principal dimensions of the vessel are:—Length B.P., 346 ft. 6 in.; breadth extreme, 50 ft. 10 in.; depth moulded, 25 ft. 6 in. She is classed 100 A1 at Lloyd's, under special survey, and is constructed with single deck and designed to carry a large deadweight cargo on a light draught. Ample water ballast is provided in cellular bottom extending to sides of the ship, and fore and after peaks. Full cargo poop and bridge are fitted and topgallant forecastle for the petty officers and crew. There are five cargo hatchways with double derricks to each, complete with all appliances for rapid loading and discharging, worked by powerful steam winches, and a large multitubular donkey boiler of ample capacity for the supply of steam to the deck machinery, steam windlass and steam-steering gear. The engines, by Messrs. George Clark, Ltd., have cylinders 25 in., 41 in. and 67 in., with a stroke of 45 in., steam being supplied by large boilers working at 180 lbs. pressure.

Camerata.—On May 9th, Messrs. William Gray & Co., Ltd. launched the handsome steel screw steamer *Camerata*, which they have built to the order of Messrs. Frank C. Strick and Co., Ltd., of London and Swansea, for La Tunisienne Steam Navigation Co., of Paris. She will take the highest class in Lloyd's and is of the following dimensions, *viz.*:—Length overall, 362 ft.; breadth, 50 ft.; and depth, 25 ft. 11½ in. with long bridge, poop and topgallant forecastle. The hull is built with deep bulb-angle frames, cellular double bottom and large aft-peak ballast tank, ten steam winches, steam-steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead, and all requirements for a first-class cargo steamer, including Porter's patent derrick sockets for dealing with heavy lifts by combining the ship's ordinary derricks. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders having cylinders 24 in., 38 in. and 64 in. dia. with a piston stroke of 42 in. and two large steel boilers adapted for a pressure of 180 lbs. per square inch, worked under Howden's system of forced draught.

Registan.—On May 9th, Messrs. William Gray & Co., Ltd., launched the large steel screw steamer *Registan*, which they have built for Messrs. Frank C. Strick & Co., Ltd., of Swansea and London. Her principal dimensions are:—Length overall, 362 ft.; breadth, 46 ft. 6 in.; and depth, 24 ft. 9 in. She is a handsomely modelled vessel of the two-deck type, with poop, bridge and forecastle and a sun deck over the bridge. Very tasteful cabin accommodation

is provided in houses on the bridge deck for passengers, captain and officers. An electric lighting installation is being fitted, including a Suez Canal projector light. The vessel will take Lloyd's highest class and has a cellular double bottom and after-peak tank for water ballast. The decks are of steel and teak. The steam windlass, steam-steering gear, steam winches, large marine type donkey boiler, and the whole of the outfit are of the most approved description, including Porter's patent derrick sockets for dealing with heavy lifts by combining the ship's ordinary derricks. The machinery is made by the Central Marine Engine Works of the builders, being of the triple-expansion type, with cylinders 25 in., 40 in. and 65 in. and a 42-in. piston stroke; she is also fitted with Weir's feed pump and heater and two large steel multitubular boilers working by Howden's system of forced draught at a pressure of 180 lbs. per square inch.

Akassa.—On May 9th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, launched from their Middleton Shipyard the steel screw steamer *Akassa*, sister ship to the s.s. *Tamele* and *Ynitsha*. The *Akassa* is a beautifully modelled vessel having very fine lines, and is specially designed with main, upper and shelter decks. The vessel is otherwise strengthened to suit the owner's West African trade. The dimensions are:—Length, 375 ft.; beam extreme, 50 ft.; depth moulded to upper deck, 25 ft. 3 in., having all the 'tween decks and houses 8 ft. in height. She is classed 100 A1 at Lloyd's, and has cellular double bottom all fore and aft, with fore and after-peak tanks for water ballast. The vessel is divided into seven water-tight compartments by means of six transverse bulkheads, and every attention has been paid to all appliances for the rapid loading and discharging of cargo, the ship having nine powerful steam winches of the builders' own design, and ten derricks capable of lifting five tons each; provision is made on each mast for a special derrick dealing with 30-ton loads, whilst the whole of the mast arrangement is strengthened to lift 40 tons. Accommodation for thirty first-class passengers is arranged under the bridge, and second-class passengers at the after end under the poop. The vessel has steel decks sheathed with wood on the poop, bridge, forecastle and promenade decks. Under the second-class accommodation aft, provision is made for large icehouses, mail rooms, specie rooms, paint rooms, lamp rooms and general store rooms. The vessel is fitted with the usual complement of lifeboats, together with six surf boats of special design for carrying palm oil through the surf. A complete installation of electric light will be fitted by Messrs. Campbell & Isherwood, including signal lamps, binnacle lamps, cargo clusters at each hatch, as well as oil lamps for emergency purposes. Steam-steering gear is placed amidships and a quick-warping steam windlass forward, steam being supplied to all deck machinery from either of the main boilers. The engines are of the triple-expansion type by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 25 in., 40 in., 68 in. by 48 in. stroke, with three main boilers working at a pressure of 180 lbs. and capable of driving the vessel at a fair rate of speed when loaded. A "Contraflo" condenser will be fitted, by which a vacuum of 27 in. can be carried in sea water up to 85 degrees, so that the engines will always develop the horse-power intended and give the best results in speed and consumption.

Mordenwood.—On May 9th, Messrs. Ropner & Sons, Ltd., Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*:—Length, 342 ft. 3 in.; breadth, 47 ft.; depth, 24 ft. 9 in. The vessel will be classed 100 A1 at Lloyd's, having main deck, poop, bridge and topgallant forecastle. The vessel has double bottom for water ballast on the cellular principle, and in after peak. She will be fully equipped with an up-to-date outfit including quick-warping steam windlass, stockless anchors, steam-steering gear amidships, and powerful screw gear aft. The appliances for loading and discharging cargoes expeditiously are very complete, and include six steam winches, steam being supplied by a large donkey boiler. The holds are entirely clear of obstruction to stowage of cargo, having centre line pillars only. The engines will be of the triple expansion type by Messrs. Blair & Co., Ltd., Stockton-on-Tees, of about 1,300 i.h.p., having two steel boilers 15 ft. 3 in. by 10 ft. 3 in., 160 lbs. steam pressure.

Natal Transport.—On May 9th, Messrs. The Northumberland Shipbuilding Co., Ltd., launched from their yard at Howdon-on-Tyne, the finely moulded steamer built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, for Messrs. The Empire Transport Co., Ltd., London. The vessel is 365 ft. long by 51 ft. 4½ in. beam by 28 ft. 4½ in. deep, and has been built under special survey to the highest class at British Corporation. The steamer has been specially designed with a view to rapid loading and discharging of homogeneous cargoes, the hatchways being very long and wide, and arranged for grain carrying in bulk, a complete set of shifting boards being fitted throughout to latest Board of Trade requirements. Ample deck gear is provided, consisting of eight steam winches by Messrs. John Lynn & Co., Ltd., Sunderland, and a large number of cargo derricks to ensure the expeditious handling of cargoes. The machinery will be supplied by Messrs. Richardsons, Westgarth and Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 40 in., 67 in. by 45 in. stroke, and three large steel boilers with 180 lbs. pressure. This vessel will carry about 7350 tons on a light draught and steam about 10 knots loaded at sea.

LAUNCHES—Scotch.

A. E. McKinstry.—On April 25th, there was launched from the works of the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, a steel screw package freight steamer, 250 ft. by 42 ft. 6 in. by 20 ft. 6 in., for service on the Great Lakes Canadian Trade. The vessel was named *A. E. McKinstry* by Miss Hunter, Brackhnn, Bearsden, and immediately after the launch was placed in the Company's dock to receive her machinery, which has also been constructed by the builders. This vessel has been built under British Corporation survey.

St. Petersburg.—On April 25th, a turbine steamer, the *St. Petersburg*, intended for the Great Eastern Railway Co.'s Harwich-Hook of Holland service, was launched by Messrs. John Brown & Co., Clydebank. The vessel is a sister ship to the *Copenhagen* and the *Munich*, also designed and built at Clydebank. The principal dimensions of the *St. Petersburg* are:—Length overall, 343 ft.; breadth moulded, 43 ft.; depth to awning deck, 26 ft. 6 in.; and measurement, about 2,600 tons gross. Accommodation is provided on the lower main, and awning decks for over 300 first-class passengers and on the lower and main decks for 110 second-class. The propelling machinery, which is being constructed by the builders, comprises a set of Parsons steam turbines, consisting of one high-pressure and two low-pressure turbines, with two astern turbines fitted within the low-pressure turbine casings. Steam is supplied by five large single-ended boilers, working on the closed stokehold system of forced draught.

Tehaka.—On April 25th, Messrs. Ferguson Brothers, Port Glasgow, launched with steam up a single-screw hopper dredger, having a capacity of 350 tons per hour, which they have built for Lyttelton Harbour Board, New Zealand. This is the second vessel built by Messrs. Ferguson for this port within the last two years.

City of Chester.—On April 25th, Messrs. Barclay, Curle and Co., Ltd., Whiteinch, launched for the Hall and City Line a steel screw steamer of the following dimensions:—Length, 422 ft.; breadth, 52 ft.; depth, 33 ft. 1 in.; gross tonnage, about 5,500 and about 10,000 tons deadweight. The vessel will class B.S. British Corporation, and has been built under special survey. Electric lighting is fitted throughout, and a complete system of fire-extinguishing is fitted to each hold. Masts are made telescopic to allow of the steamer navigating the Manchester Canal. All the accommodation is heated by means of steam pipes and radiators. Engines and boilers capable of driving the vessel 11 knots at sea will be supplied and fitted by the builders. All boilers and steam pipes have been covered with Messrs. Matthew Keenan's non-conducting composition.

Lisboa.—On April 26th, there was launched from the yard of Messrs. David & William Henderson & Co., Ltd., at Meadowside, Partick, the handsomely modelled twin-screw passenger and mail steamer *Lisboa*, which they have built to the order of The Empreza Nacional de Navegacao a Vapor, of Lisbon. The dimensions of the vessel are:—Length overall, 452 ft.; breadth, 54 ft.; depth moulded to shelter deck, 37 ft. 6 in., with a gross tonnage of about 7,200. The vessel has been specially designed for the owners' passenger and mail service between Portugal and the Portuguese possessions in Africa. The last addition to the owners' large

fleet of fine steamers is built to class 100 A1 in Lloyd's Registry, and is fitted with accommodation for first, second and third-class passengers, and will be one of the largest and most up-to-date vessels flying the Portuguese flag. The first-class accommodation is fitted amidships, and is of an extremely comfortable and artistic description. There is sleeping accommodation for 110 first-class passengers. The second-class passengers, numbering sixty-four, are placed aft, and forward, on the upper deck, accommodation is provided for 142 third-class passengers, and on the same deck aft arrangements have been made for carrying 100 steerage passengers. The vessel will be lighted throughout by electricity supplied by three separate generators, which will also supply current for the numerous ventilating fans, special attention being devoted to the ventilation of the steamer. She is fitted with a large refrigerating chamber, ten steam winches, four hydraulic cranes, steel derricks and everything required for the rapid loading and discharging of cargo. The propelling machinery, which is also being constructed by Messrs. Henderson, consists of two sets of triple-expansion engines with cylinders 25 in., 41 in. and 67½ in. dia. by 48 in. stroke; there are six single-ended boilers working at a pressure of 190 lbs.

Zeelandia.—On April 26th, Messrs. Alex. Stephen & Sons, Ltd., Linthouse, launched the large twin-screw steamer *Zeelandia*, which they have built to the order of the Koninklyke Hollandsche Lloyd, of Amsterdam. The vessel is intended for their mail and passenger service between Holland and South America, and will run in conjunction with the *Hollandia*, which was built at Linthouse last year. The dimensions of the vessel are:—Length, 460 ft.; breadth, 55 ft.; depth, 37 ft. While principally designed for passengers, she will carry a large cargo, in addition to the great quantity of coal and stores required for the voyage from Amsterdam to Buenos Ayres; and her cargo gear has been arranged for the speedy and economical handling of cargo of any weight up to 30 tons in one lift, by means of sets of three powerful winches at each hatch. A large space has been divided off and insulated for the reception of frozen goods, the refrigerating apparatus being on the CO_2 system by Messrs. J. & E. Hall, Ltd. The bulkheads dividing the cargo holds are carefully arranged to make the best possible sub-division, and in addition the Stone-Lloyd system of automatically closing the water-tight doors has been fitted throughout so as to make the vessel practically unsinkable. The passenger accommodation is very extensive, occupying four decks, and consists of first-class—including a number of special suites—intermediate and third class. The working part of the vessel is unusually complete, and comprises many other offices besides the usual galleys and pantries—such as a complete laundry, comprising washing, drying and ironing machines for every type of laundry work; a bakery and baker's shop with electrical dough mixers and special ovens for baking and daily supplies of bread, as well as other bakers' confections; sculleries with electrical potato peelers, refrigerated ice cream makers, water coolers, electrical dish-washers, etc., etc. In addition may be mentioned the barber's shop, a photographic dark-room, a Marconi installation with printing-room, hospitals with a pharmacy and operating-room attached. The ship's fittings include telemotor steering gear, telephones for docking and other purposes, a searchlight, an electrically operated steam whistle, the submarine signalling apparatus, Clayton's disinfecting machine, and Welin's patent davits; while in the engine-room special mention may be made of a baker's blower for drying the double bottom tanks, and a Stone's ash expeller, fitted in addition to the See's ash ejectors. The engines, which have also been constructed by Messrs. Stephen, are of the twin-screw triple-expansion type, and supplied by steam from three double-ended boilers with a single-ended boiler in reserve, all fitted with Howden's forced draught. The auxiliary machinery is very extensive and of the most modern type in all its details. Messrs. Wailes, Dove & Co.'s "Bitumastic" deck covering was applied to flush up deck plating on upper shelter poop, bridge and forecastle decks, and their "Bitumastic" enamel was applied in way of winches and gutterways.

Sogenada.—On April 30th, there was launched at Rutherglen the steel screw tug *Sogenada*, which has been built for Canadian owners. Compound surface condensing engines of 300 i.h.p. will be supplied.

Olympus.—A steam drifter built to the order of Mr. Joseph Smith and others, Ianstown, Buckie, was recently launched at Fraserburgh. The vessel, which was named *Olympus*, is 83 ft. in length, 16½ ft. in breadth, and has a hold depth of 8½ ft.

Steel Screw Steamer.—On May 3rd, Messrs. Archd. McMillan and Son, Ltd., Dumbarton, launched a steel screw steamer which they have built for service on the Canadian Lakes. The vessel is of dimensions:—Length, 256 ft.; breadth, 44 ft.; depth moulded, 26 ft. Superior accommodation is provided forward. On top of the forecastle there is the captain's quarters, also large observation room—the wheel-house being placed on top of same—and under the forecastle there is accommodation for the officers and crew, and two large spare state-rooms with bath-room, etc. The engineers are berthed in rooms alongside the engine casing. The vessel is fitted throughout with electric light. The machinery, which is fitted aft, is being supplied by Messrs. Muir and Houston, Ltd., Glasgow. The vessel and machinery have been built to the highest class of the British Corporation.

Heito Maru.—On May 5th, Messrs. Ferguson Bros., Port Glasgow, launched a large twin-screw barge-loading bucket dredger for the Southern Manchurian Railway Company for service at Dalny Harbour. The vessel, which was launched complete with machinery aboard and steam up, is of the bow-well centre bucket ladder type, and is capable of raising 1000 tons per hour from a depth of 40 ft. She was named the *Heito Maru* by Miss Dorothy Ferguson, Greenlaw, Port Glasgow. The vessel is built to Lloyd's highest class. Side shoots are arranged for discharging the dredged material over either side into hopper barges, the lifting and lowering of each shoot being worked by an independent steam engine. The main engines are employed for either propelling or driving the dredging gear. Two large multitubular boilers supply steam to the various engines. The accommodation for the officers and crew is fitted forward and is commodious and handsomely finished. Electric light is fitted throughout. On May 10th the vessel was taken on her dredging and speed trials when the contract speed was attained.

Ngatoro.—On May 5th, there was launched at Port Glasgow the steel screw steamer *Ngatoro* for the Blackball Coal Co., New Zealand. The vessel, which has been built in excess of Lloyd's highest class, is of the following dimensions:—Length, 225 ft.; breadth, 33 ft.; depth, 16 ft. 8 in. After the launch the steamer was towed to Glasgow, where the machinery will be supplied. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the engine-room tank top, boiler-room bilges, bunkers and bridge spaces.

Roseric.—On May 9th, there was launched at Port Glasgow the shelter-deck screw steamer *Roseric*, of 4,710 tons gross, which has been built to the order of Messrs. Andrew Weir and Co., of London and Glasgow. Her dimensions are Length, 405 ft.; breadth, 52 ft.; and depth, 28 ft. 5 in. The engines will have cylinders 27 in., 44 in. and 73 in. by 48 in. stroke. The vessel is fitted throughout with electric light, and has been built in excess of Lloyd's highest class. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the boiler-room tank and bunkers and deep tank, and their "Bitumastic" covering to tank top in boiler-room.

Sergipe.—On May 10th, Messrs. Yarrow & Co., Ltd., launched at Scotstoun the last of the ten destroyers built by them for the Brazilian Government. The vessel was named the *Sergipe* by Madame Jorge, the wife of Captain Amynthas José Jorge, the commander of the Brazilian cruiser *Barroso*. Admiral Duarte Huet de Bacellar who has just returned to this country to resume the position of the chief of the Brazil Naval Commission in Europe, Admiral F. M. de Lemos Basto, Captain Bartholomeo da Silva, and Captain Rosauro de Almeida were present at the launch, together with numerous other officers of the Brazilian Navy. The *Sergipe* is 240 ft. long by 23 ft. 6 in. beam and will have a speed of 27 knots.

LAUNCHES—Irish.

St. Albans.—On May 10th, Messrs. Workman, Clark and Co., Ltd., Belfast, launched from their South Yard a new steamer designed and built for the Eastern and Australian Steamship Co., Ltd., London. The vessel is 381 ft. in length with a gross tonnage of about [illegible] and she will trade between Australian and Chinese ports. Accommodation for sixty

three first-class passengers and thirty-six second-class passengers is provided. Accommodation for European steerage passengers has been arranged in the poop space and for Chinese steerage on the main deck forward. As the vessel is intended for service in tropical climates special attention has been given to the ventilation of the passenger accommodation throughout the vessel. The cargo space is divided into four holds, and one of these has been insulated and prepared for the carriage of frozen meat, while the 'tween deck space over this hold has also been insulated and fitted up for meat and fruit cargoes and perishable stores. For the preservation of these cargoes and stores a plant of refrigerating machinery has been installed. Each of the holds is furnished with a large hatchway suitably equipped with steam winches, derricks and other appliances necessary for expeditiously handling general cargo. The propelling machinery consists of a set of triple-expansion engines, having all the most modern improvements and auxiliaries and supplied with steam from four single-ended steel cylindrical multitubular boilers working under forced draught. The vessel has been built under special survey for the highest class in Lloyd's Registry of Shipping, and fulfils the requirements of the British Board of Trade.

Murital.—An important addition has been made to the fleet of the Tyser Line, Ltd., by the launch of the twin-screw steamer *Muritai* from the Belfast shipyard. The new steamer is the sixth vessel built and engined by Messrs. Workman, Clark & Co., Ltd., for the Tyser Line. The *Muritai* is a well-proportioned vessel of the shelter-deck type, 486 ft. in length, with a gross tonnage of about 7 300 and has been built under Lloyd's special survey for the highest class in their registry. She is to be engaged in the regular frozen meat carrying service between this country and Australia. The cargo space is divided into five holds, three of which have been insulated and otherwise prepared for the carriage of frozen meat cargoes. For the preservation of these cargoes an extensive installation of refrigerating machinery has been arranged. Each of the holds is furnished with a large hatchway suitably equipped with steam winches, derricks and other appliances necessary for dealing expeditiously with a full general cargo. Accommodation for the officers and engineers, together with a few passengers has been fitted up in a large midship deckhouse. The propelling machinery consists of two sets of triple-expansion engines having all the latest improvements, with four steel cylindrical single-ended boilers working under forced draught.

TRIAL TRIPS.

Levuka.—The s.s. *Levuka*, built by Messrs. Alex. Stephen and Sons, Ltd., Linthouse, for the Australasian United Steam Navigation Co., Ltd. for the Australian Coasting and Pacific trade, has just completed a series of successful trials in the Firth of Clyde. The trials were most satisfactory in every way, the requirements of the owners being amply fulfilled in all respects, and the whole of the machinery ran throughout without a hitch. After the trials the vessel returned to the Tail of the Bank, and was expected to leave for Australia soon after. See May issue for launch.

Cabo Da Roca.—The powerful screw tug *Cabo Da Roca*, recently launched at South Shields, has performed her official trial at sea. She has been built to the order of the Harbour Board of Lisbon, is specially designed for sea and harbour towage work, also for fire and salvage purposes. The dimensions are :—Length 100 feet ; breadth 22 feet ; depth 12 feet moulded. She is built of steel, under special survey to class 100 A1 at Lloyd's. The deck machinery throughout is of the most recent and improved type, and the vessel is equipped with a Clayton's patent fire-extinguishing and disinfecting apparatus. There is also a complete installation of electric light, including a powerful searchlight. In the engine-room there is fitted a powerful centrifugal salvage pump, capable of discharging 550 tons of water per hour, and a powerful duplex fire pump capable of discharging 250 gallons per minute. The propelling machinery consists of one set of triple-engines, having cylinders 14½, 23½ and 38 inches diameter, with a stroke of 27 inches, steam being supplied by a large single-ended boiler working at 180 lb. pressure. After making a series of four runs off Whitley, when a speed of 12·3 knots per hour was attained, the tug was subjected to a continuous full power trial of six hours, throughout the whole of which time the machinery worked with smoothness and satisfaction.

Christopher.—On April 23rd, the fine steel screw steamer *Christopher*, built by Messrs. The Tyne Iron Shipbuilding Co., Ltd., Willington Quay on Tyne, for Messrs. The Booth Steamship Co., Ltd., Liverpool, left the Tyne for her official trial trip. This vessel, which is of the following dimensions, *viz.* :—Length 375 feet ; breadth 50 feet ; depth moulded 33 feet 3 inches, has been built to Class 100 A1 at Lloyd's, shelter deck rule, and has poop, bridge and forecastle. She is also fitted with water ballast fore and aft on the cellular system, and with all the latest improvements for rapid loading and discharging of cargo, including nine double-cylindered steam winches, direct-acting steam windlass, large multitubular donkey boiler, and steam-steering gear. She is handsomely fitted up with accommodation for a number of first and second-class passengers. The propelling machinery, which has been constructed by Messrs. The North-Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of their latest type of triple-expansion engines, having cylinders 25 in., 40 in., 68 in. by 48 in. stroke, steam being supplied by three large steel boilers working at a pressure of 180 lbs. per square inch. A number of runs over the measured mile off Whitley Bay were taken, the machinery working splendidly throughout and giving great satisfaction to all concerned, maintaining a mean speed of 12 knots.

Hopeful.—On April 23rd, the s.s. *Hopeful*, built by Messrs. W. Harkess & Son, Ltd., of Middlesbrough, to the order of Messrs. The British & Continental Steamship Co., Ltd., of Liverpool, was taken for her official trial trip, when a speed of 10½ knots loaded was maintained, and everything worked to the entire satisfaction of the owners. The vessel loaded a cargo of 1,012 tons of pig iron on a mean draught of 13 feet. Machinery, consisting of a set of triple-expansion engines with cylinders 16 in., 27 in., and 44 in. diameter by 30 in. stroke, are supplied with steam at 180 lbs. pressure from two cylindrical boilers. The patent "Contraflo" condensing system with special temperature regulating valve, forms an interesting feature of the machinery, and at full speed a high vacuum was easily maintained. See May issue for launch.

Shieldhall.—The twin-screw steamer *Shieldhall*, built by Messrs. William Beardmore & Co., Ltd., Dalmuir, for the Corporation of Glasgow, recently completed her official trials on the Firth of Clyde. The results of the trials were very satisfactory, all the conditions of the contract being amply fulfilled, and the representatives of the Corporation expressed themselves as highly pleased with the vessel's performance. See April issue for launch.

Tern.—On April 27th, the s.s. *Tern*, lately launched by Messrs. Short Brothers, Limited, from their shipbuilding establishment at Pallion, Sunderland, to the order of Messrs. Ch. Th. Boe & Son, of Arendal, left the Wear for her official trials. Her dimensions are :—Length 269 feet ; beam 37 feet 9 inches ; and depth moulded 20 feet 4 inches, and she will carry a deadweight of 2,750 tons on a light draught. The vessel, which is constructed on the deep frame principle with one deck laid, will take Lloyd's highest class, and is of the self-trimming type with extra large hatchways. Water ballast is provided throughout the cellular double bottom and in both fore and aft peaks. Pillars in holds are dispensed with to enable large pieces of machinery to be shipped. Five steam winches, steam windlass, steam-steering gear controlled from standards in wheelhouse and on upper Flying Bridge and connected by rods and chains to quadrant, are supplied, taking steam from a "Horace" patent donkey boiler fitted in stokehold. The machinery, which throughout the trial worked very satisfactorily, is by Messrs. The North-Eastern Marine Engineering Co., Limited, of Sunderland, and consists of engine with cylinders 19, 31 and 51 inches diameter and a stroke of 36 inches, driven by a large multitubular boiler 16 feet by 10 feet 6 inches, 180 lbs. pressure. On the trial runs the steamer maintained a speed of 16½ knots.

Malmanger.—On April 27th, the new Wear-built steamer *Malmanger* was taken to sea upon her official ballast trial. The trial was in every way satisfactory, a speed of 11 knots being obtained. A Cochran (Annan) patent seamless furnace donkey boiler has been fitted. See May issue for launch.

Eastern Prince.—On April 28th, the steamer *Eastern Prince* left the Wear for her official trials. The vessel was run over the measured mile and a speed of 12 knots attained, which was considered highly satisfactory, with everything working well. See May issue for launch.

Keystorm.—On April 20th, the steamer *Keystorm*, which has been built at the Neptune Works, Newcastle-on-Tyne, of Messrs. Swan, Hunter, and Wigham Richardson (Limited), for Messrs. The Keystone Transportation Company, of Montreal, had a satisfactory trial trip off the Northumbrian coast. The steamer has been built for the Canadian Lake trade to the highest class in the classification of the British Corporation for the Survey and Registry of Shipping. She is 250 feet in length by $42\frac{1}{2}$ feet beam, and will carry 2,300 tons d.w. on a light draught of water. The triple-expansion engines have been constructed by Messrs. The North-Eastern Marine Engineering Company at their Wallsend works. On the trial trip they worked without the slightest hitch, the vessel attaining a speed of about 10 knots per hour. On the conclusion of the runs the steamer proceeded to the Tees, under the command of Captain Wright Mason, where she will load for Canada. A Cochran (Annan) patent s amless fu nace donkey boiler has been fitted.

Itauba.—On April 30th, the new twin-screw passenger steamer *Itauba* left Troon for official trials. These consisted of a speed trial on the measured mile at Skelmorlie, and afterwards a continuous steaming trial of about an hour's duration. The contract speed both for the measured mile and on the continuous trial was exceeded. See May issue for launch.

Tamele.—On April 30th, the new steamer *Tamele* proceeded on her official trial trip after adjusting compasses in Hartlepool Bay. The engines, by Messrs Richardsons, Westgarth & Co., Ltd., Hartlepool, are of special interest because of the installation of the "Contraflo" system of condensation and feed water heating the sizes being as follows:—25 in., 40 in., 68 in., by 48 in. stroke, with three main boilers working at 180 lbs. pressure. A leading feature of the design, which will appeal to those responsible for the economics of marine engine running and maintenance, is that the ordinary simple air pump is retained, but by an ingenious method of temperature regulation its air-withdrawing capacity can be so adjusted to the demand that the thermal efficiency of the engine is at a maximum under all conditions of service, thereby very favourably influencing the consumption of coal. This system was fitted some time ago on Messrs. Elder, Dempster & Co.'s s.s. *Bassam*, also built by Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., and after a voyage to the West Coast of Africa the results obtained were strikingly satisfactory. It was found in the *Bassam* that a vacuum of 27 in. could easily be carried in the tropics, with the obvious advantage that the speed of the ship was maintained, whereas with the ordinary type of marine condenser tropical water produces a considerable fall in the vacuum, and as a consequence the speed suffers. The extreme flexibility of the "Contraflo" system was well illustrated in the trial of the *Tamele*, as a vacuum of 29 in. was obtained with a 30.2 in. barometer, a result probably unsurpassed with marine engines of the reciprocating type. The lead given by Messrs. Richardsons, Westgarth & Co. with this new development is being rapidly followed all the world over, the most recent application of the "Contraflo" system being to the s.s. *France*, of 30,000 horse power, at present being built by Messrs. The Chantiers & Ateliers de St. Nazaire for Cie General Transatlantique. The trial was in every way satisfactory, a mean speed of $12\frac{1}{4}$ knots being obtained over the Whitley mile. See March issue for launch.

Elmmoor.—On May 2nd, the new screw steamer *Elmmoor* built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of Messrs. Walter Runciman and Co. Newcastle-on Tyne, was taken to sea on her official trial trip. The trial was in every way satisfactory to all concerned, and the vessel afterwards proceeded to Dunston to load, under the command of Capt Evans. See May issue for launch.

Pentwyn. On May 9th the *Pentwyn* was taken to sea on her official trip, and after a series of several runs on the measured mile at Whitley, with the vessel fully laden, she averaged a speed of $10\frac{1}{2}$ knots. The trial was a complete success in every way and gave entire satisfaction to the owners, who were on board; the vessel is a splendid example of the modern up-to-date cargo carrier. See May issue for launch.

Bheestie. To the majority of people, and especially those who have travelled in India the above name will immediately appeal to them as the native term for a water carrier and this, in conjunction with other features, is what this vessel has been designed and constructed for, by Messrs. James Pollock, Sons & Co., Ltd., 3 Lloyd's Avenue, London, for The Felixstowe Dock & Railway Co. The dimensions of this vessel are —Length overall 72 feet; breadth 15 feet 6 inches; depth 8 feet fitted with compound service condensing engines capable of developing nearly 200 I.H.P. The *Bheestie* is fitted with a special tow-hook att. Pollock's Patent Stern Frame heavy fenders, tumble-home bulwarks, steam anchor gear, and these features, coupled with the vessel's fine speed will enable her to carry out her Admiralty duties to perfection especially when consideration is given to the fact that she has been constructed to perform functions such as the following —(a) Freshwater boat with rapid discharge. (b) Handy tug. (c) Officers' service vessel. (d) Cargo steamer. (e) Fire float. (f) Salvage steamer. (g) Lifting lighter. (h) Mine and Anchor-laying vessel. (i) Dispatch boat; qualities that have not, as far as we are aware of, been attained all in one vessel—of the size—before. One of the greatest difficulties that Messrs. Pollock had to contend with was the restriction laid down that the vessel was to be as efficient a tug when the tanks were empty as when they were full, and in both cases on a very light draught. During the official trials which proved most satisfactory in every way, the various performances laid down in the specification were in each case exceeded, and after a successful cruise the vessel arrived at Felixstowe last Saturday and immediately started her duties.

Indian Transport.—On May 9th, the finely modelled steel screw steamer *Indian Transport*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. Furness, Withy & Co., Ltd., for The Empire Transport Co., Ltd., London, of which Messrs. Houlder Bros. & Co., Ltd., are the managers, left the Tyne to undergo her official trial trip. Her dimensions are 365 ft. long by 51 ft. $4\frac{1}{2}$ in. beam by 28 ft. $4\frac{1}{2}$ in. deep, and is designed to carry about 7350 tons on a light draught. The deck erections consist of long bridge, long poop, topgallant forecastle, the accommodation which is ample, being placed in steel houses on the bridge deck. The steamer has been specially designed for the rapid loading and discharging of homogeneous cargoes the hatchways being very long and wide, and are arranged for grain carrying in bulk, a complete set of shifting boards being fitted throughout to latest Board of Trade requirements. Ample deck gear is provided, consisting of eight steam winches by Messrs. John Lynn & Co., Ltd. Sunderland, and a large number of cargo derricks to ensure the expeditious handling of cargoes. The usual water ballast arrangements for light passages are provided for. The machinery has been supplied by Messrs. Richardsons Westgarth & Co., Ltd. Sunderland consisting of engines with cylinders 25 in., 40 in. and 67 in. by 45 in. stroke, three large steel boilers with 180 lbs. pressure. The trial trip proved in every way highly satisfactory, and a speed of 12 knots was easily obtained.

Telena.—Successful speed trials have been obtained on board the London tank steamer *Telena* off the Tyne. The *Telena*, which has been extensively overhauled by Messrs Smith's Dock Co., in their Bull Ring Dock, North Shields has been fitted with the oil fuel installation. There was a full pressure of steam maintained on the boilers and the mean speed of the vessel was $11\frac{1}{2}$ knots per hour which was considered highly satisfactory. The consumption of oil per twenty-four hours is 18 tons, as compared with 32 tons of coal

Vincent. The steamer *Vincent*, built at Govan to the order of the Booth Steamship Co. for trade between Liverpool and the Amazon and Madeira rivers recently ran trials with thoroughly satisfactory results. The vessel is 18[illegible] ft. long with a moulded breadth of 33 ft. and a moulded depth of 17 ft. 3 in. On four runs at full power over the measured mile a mean speed of over [illegible] knots was attained the machinery working very smoothly and to the entire satisfaction of the owners' representative. A Cochran (Annan) patent seamless furnace donkey boiler has been fitted.

Shallow Draught T.S. Steel Tug. On May [illegible] the first of two shallow [illegible] tugs for the river Euphrates [illegible] trials. The [illegible] is [illegible] ft. width [illegible] ft. maximum the water being rough she [illegible] out to full power [illegible] the propellers raced [illegible] however she made over

1 miles. The launch is fitted with large marine return-tube boiler built under Lloyd's survey for 120 lbs. working pressure, twin sets of "Hayes" standard engines, each having cylinders 6 and 12 in. by 8 in. stroke. These main engines exhaust into a condensing plant of entirely new design which takes up very little space and is driven by a compound engine having cylinders $3\frac{1}{2}$ in. and 7 in. by 5 in. stroke.

Prince George.—The s.s. *Prince George* has completed its trials at sea off the mouth of the river Tyne, when a speed of over 10 knots an hour was obtained. On May 7th the vessel left Wallsend-on-Tyne, Messrs. Swan, Hunter and Wigham Richardson taking on board a party of over fifty guests as far as Falmouth in Cornwall. The vessel was not pressed, but ran at about 15 knots an hour, so as to take some thirty-six hours for the trip. After the passengers had landed, Captain Underhay made his ship ready for her long voyage to British Columbia, going *via* the Straits of Magellan. See May issue for launch.

Brevennik.—On May 11th, the new steel screw tug *Brevennik*, built at Leith, to the order of the Appanage Saw Mills of Archangel, underwent her trials on the Firth of Forth. Notwithstanding the disagreeable and adverse weather conditions, a speed of over 10 knots was obtained, being half a knot over the guranteed speed. The towing results were also entirely satisfactory.

Djerissa.—On May 13th, the handsome steel screw steamer *Djerissa*, built by Messrs. Wm. Gray & Co., Ltd., to the order of Messrs. Frank C. Strick & Co., Ltd., of London and Swansea, for La Tunisienne Steam Navgiation Co., of Paris, was taken for her trial trip. On the trial trip a vacuum of $28\frac{1}{2}$ inches was maintained with the barometer at 29·9 inches, the whole of the machinery working most satisfactorily. The leading feature of the condenser design is a new method of temperature regulation by means of which the air withdrawing capacity of the air pump can be so adjusted to the demand that the thermal efficiency of the engines is at a maximum under all conditions of working, this arrangement having a favourable influence on economy. See May issue for launch.

Kingstown.—The new steel screw steamer *Kingstown*, built by Messrs. Ramage & Ferguson, Ltd., to the order of Messrs. John Weatherill & Sons, Dublin, for their coasting trade, has completed her loaded trial trip on the Firth of Forth, and on the measured mile attained a speed of $11\frac{1}{2}$ knots, which is in excess of the guaranteed speed. During the trials the ship and her machinery gave every satisfaction. A Cochran (Annan) patent seamless furnace donkey boiler has been fitted. See May issue for launch.

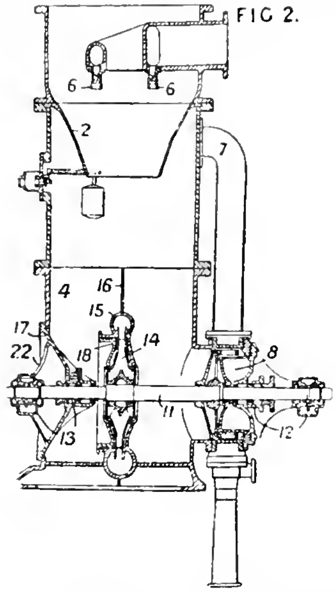
Vole.—On May 12th, there was launched on the Clyde the *Vole*, a steam yacht of about 160 tons y.m., built to the order of Mr. W. Bow, of Paisley. The dimensions of the vessel are:—Length, 105 ft.; breadth, 18 ft.; and depth, 11 ft. 6 in. The machinery is designed to give a speed of about 11 knots. The vessel was launched with steam up, and proceeded at once on trial.

The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs. E. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

No. 27487.—Condenser Systems. In condenser systems having separate pumps (8, 14) for removing air and water from the condensers, the water is removed by a centrifugal pump (14) arranged within a hot-well (4) formed in the condenser casing. The air-pump (8) is preferably of the Leblanc type, and is in this case arranged on the same shaft (11) as the water pump. The condenser is provided with water nozzles (6), and a partition (2) beneath which is the outlet (7) to the air-pump. The shaft (11) is carried by two pairs of bearings (12, 13), the outer bearing of each pair being carried by webs (22). In order to allow of access to the pump (14), the part (17) of the hot-well casing carrying the bearings (13) is removable. A part (15) of the outer casing of the pump (14) is secured by webs (16) on the condenser casing; the other part (18) of the pump is removable. The pump casing (15) may also be formed in one with the condenser casing. A steam jet ejector may be used as an air-pump.

FIG 2.



No. 28376. Turbines.—Elastic-fluid Turbines.—In turbines of the type in which the working fluid is directed several times backwards and forwards through the running blades of the rotor, the pressure energy of the working fluid is transformed into kinetic energy by small amounts at a time in the guide blades only and only a small total drop of pressure takes place in the chamber, the amount of expansion being never greater than four volumes. Several such turbines may be arranged together as pressure stages in a turbine unit. The low-pressure stage may be similar to the straight-through type described in specification No. 17872, A.D. 1908. The compound turbine may be grouped with low-pressure annular-admission turbines in marine plant. Figs. 2 and 3 represent diagrammatically part of an arrangement of steam passages in a turbine of six stages. The high-pressure steam enters at *f* and, after passing through the blades once, the stream is

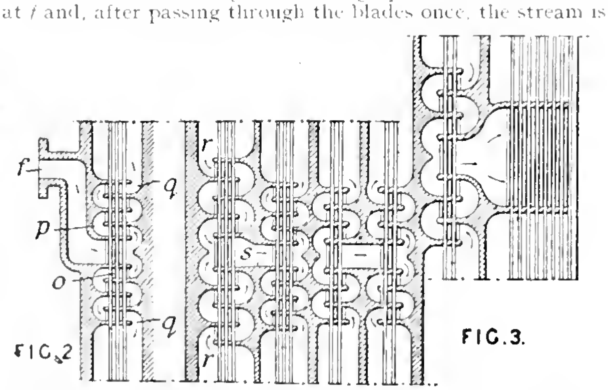


FIG.2 FIG.3.

divided, part passing along the way *p* and the other part along the way *o*. At *q* the steam is led into the open wheel space and passes either through the rotor or over the blading to the inlet side again. It is then received and redirected by the open guide passages *r*, Fig. 3, in the same stage, and, after being passed several times through the same rotor as before, it is guided to the port *s* and thence to the second stage. In the second, third, fourth and fifth stages the process is similar, the first set of directing-passages being shown for the second and fourth stages and the second set for the third and fifth stages. In the sixth stage, the steam is passed straight through the bladings, over or through the rotor to the inlet side again and then straight through the bladings a second time and is exhausted, as described in the before-mentioned specification. Labyrinth packing as described in specification No. 28047, A.D. 1907, or cellular packing may be used to pack the rotating parts.

The Marine Engineer

And Naval Architect.

LONDON, JULY, 1910.

THE LOSS OF THE "PLUVIOSE."

SUBMARINE-BOAT enterprise has paid a heavy toll in human life and in substance, having regard to the comparatively short time and small number of vessels which have been built, and our sympathies go out to the French nation and to the families of the victims in the catastrophe which overwhelmed the French submersible. The serious risk of using these craft at present is well exemplified in the circumstances attending the disaster, occurring as it did in broad daylight, in clear weather and under conditions which should have made the surrounding circumstances well known to those on board the submersible. The salvage of the vessel with its dead crew has taken longer than was anticipated by most people, having regard to the provision of lifting rings on the boat and the proximity of a naval arsenal to the scene of disaster. The difficulties of salving vessels of this description in time to save the crew have been fully appreciated by the British Admiralty, by enforcing the condition that every member of the crew shall be a trained diver who has assigned to him, stowed in a handy place, a light form of diving dress of such a nature as to be readily put on, such dress being connected by a flexible pipe with the ordinary air service under valve control. The man can don the dress and inflate it in considerably under a minute and as each outfit is provided with a purifier, sufficient air is available for one hour or upwards, so that each man on board when properly equipped has a chance of leaving the vessel when submerged, through one or other of the exits provided in the hull. In the case of the *Pluviose* there does not appear to have been any provision of this sort, which is extremely unfortunate, as there seems to be evidence that two men at least were alive for many hours after the accident happened. Another aspect of the case is worthy of consideration, *viz.*: whether something cannot be done by the provision of vessels containing liquid air material whereby assistance could be rendered in keeping the water out of a damaged vessel. It will be remembered that after being struck by the steamer the submersible sank by the stern with her bow protruding from the water. This condition seems to have lasted for some ten to fifteen minutes, and one is led to think that the stern was more damaged than the bow, so that the stern sank first and rested on the bottom of the sea, while the bow was sustained in a floating condition for a short period. Under these conditions it would seem that the water getting in at the stern gradually rose and compressed the air in the fore part of the boat, and if these conditions had continued and no escape of air had taken place, the whole of the crew might have been rescued. It would seem, however, that the compressed air gradually escaped, and the hull filled with water and sank. There was evidently some leak of air from the hull forward, and one is led to wonder whether the forward water-tight door was closed so as to imprison the air behind the injured part of the hull. Or again, given a leak that could not be stopped, would a reasonable supply of liquid air enable the internal pressure to be maintained to exclude the water for a sufficient length of time to allow the crew to escape? Further, if the centre part of the hull had been uninjured, could the injured parts be entirely isolated and any water be driven out from the central part by the pressure from the liquid air discharge, so that the hull would have sufficient buoyancy to rise to the surface, when the men could be liberated without difficulty? If any beneficial result could be achieved in the manner suggested, then it appears that a store of liquid air is an essential in the equipment of every submarine.

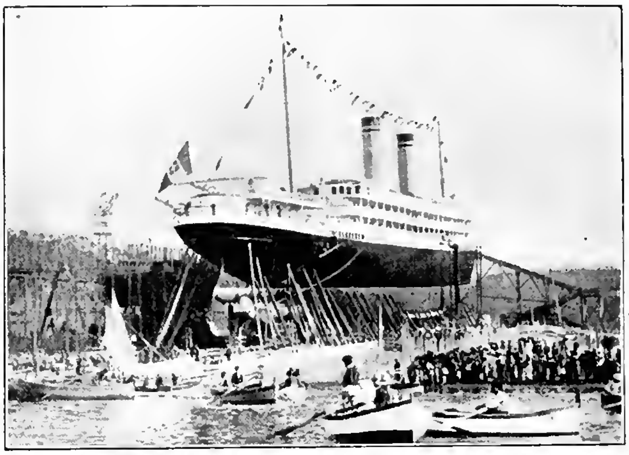
MARINE ENGINEERS' CERTIFICATES

THE Board of Trade certificates granted to marine engineers have a considerable value in the public eye; they represent qualifications and service, and the sea service is essential in a very special seuse. The Board of Trade has emphasized this in the recent proposal to extend the sea service period from twelve to eighteen months, and, having done so, there must be a very strong reason given to reduce the period for the introduction of an alternative, and that alternative must be a very good equivalent to compensate for the reduction. The wording of the proposal does not appear to carry the conviction that the importance of this is realized. We trust that the whole subject, embracing the attendance, the course taken at the Technical College, laboratory practice and the necessary class certificates, will be specified distinctly whether the course is intended to take the place of workshop service or sea service. It is as important in the one case as in the other to know what classes have been taken, how they have been taken, and to what extent the laboratory has been made use of by the candidate for the marine engineer's certificate. There is no stipulation made in the regulations regarding the laboratory attendance, so that the examiners have no justification for asking evidence of such attendance. It appears somewhat unreasonable to specify that no technical college can be placed on the approved list unless it has an engineering laboratory—except on the presumption that such an equipment gives the hall-mark of fitness to it—yet the student is not laid

under the obligation of devoting at least a portion of his service in connection with it. We commend the attention of the Marine Department of the Board of Trade to the whole subject of workshop and sea experience. The proposals in the main are in the right direction so far as the practical experience is concerned, but the Technical College training evidently requires to be made more exact and definite, as it must be borne in mind that the workshop and sea experience give the grit and stamina to our engineers, and any substitute admitted for either must be as exacting in its terms. The value and worth of the certificate must be upheld and maintained. The introduction of a third certificate after six months' sea service would serve a good end, and the question is at least worth discussing.

STABILITY OF VESSELS.

THE paper recently read before the members of the Institute of Marine Engineers, on "The Stability of Ships" revives the memory of several unhappy events which may be fittingly illustrated as typical cases of those incidentally referred to in the paper, or bearing upon the subject matter. The *Baron Aberdare*, a sailing ship of 1,700 tons, broke away from her moorings in the Victoria Dock, London, under the pressure of a gale of wind and capsized, in January, 1884. This was a case where the wind pressure upset the vessel, unprepared for a gale at the mooring berth and lacking the weight adjustment which would have given her stability in sea trim. The passages made by the *Cutty Sark* and others of the old sailing clippers is sufficiently fresh in our memories to show that although some of them were very wet ships and uncomfortable at times, heeling over under a press of canvas, they held on well to their work. There have been cases where the initial stability on launching has been based on too narrow a margin to allow for eventualities; the overturning of the *Daphne* on the Clyde, and of the *Principessa Iolanda*, are instances of capsizing in the process of launching. The *Maria Rickmers* was a fine looking ship, fitted with auxiliary engines and propeller, steaming about eight knots when circumstances required in the regions of calms; unhappily she was lost while on a part of her voyage under ballast trim, having failed to reach her destination from an unknown cause, the possibility being that too small a margin had been allowed to steady her while proceeding to a loading port. These are typical cases, showing the need of some ready method of testing the stability of a vessel in confirmation of the usual data evolved by the builders. The cases are fortunately rare where an apparent want of care and forethought, lack of knowledge, or it may be a mistaken sense of duty has led to disaster, by the balance of forces being upset under unlooked-for conditions—the beam tilted beyond recovery. The percentage of accidents and losses is very small where there is a suspicion of instability being at least a contributory cause, but there are sufficient to justify the inventor elaborating a simple means to verify the question of where stability can be relied upon in the loading of a ship. The overturning of the *Austral* in Sydney Harbour is hardly a case in point, but even here the



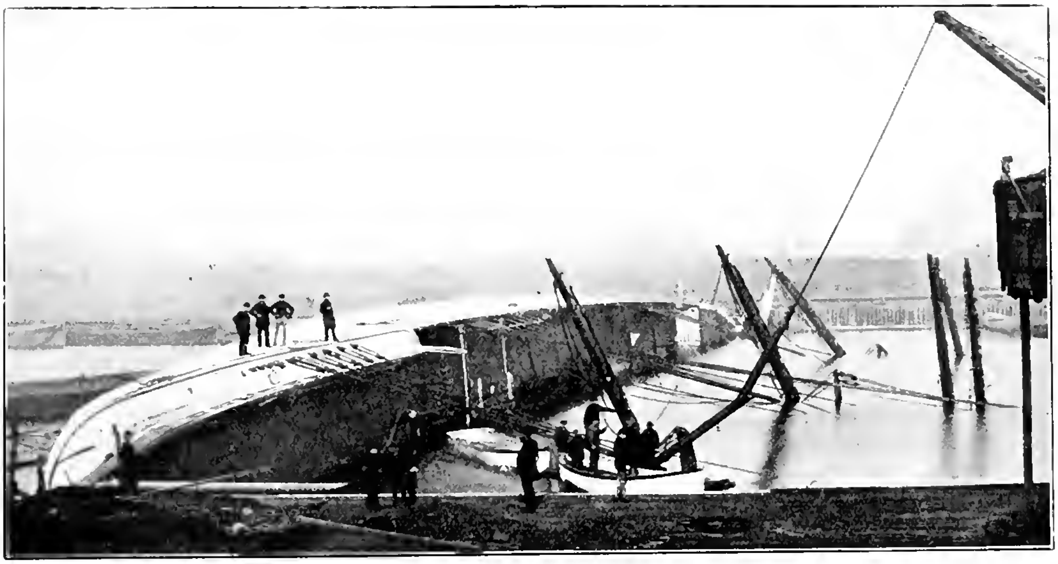
The *Principessa Iolanda.*

importance of the subject was not realized, and the fact of an appliance for testing being on board might have called attention to the danger in time.

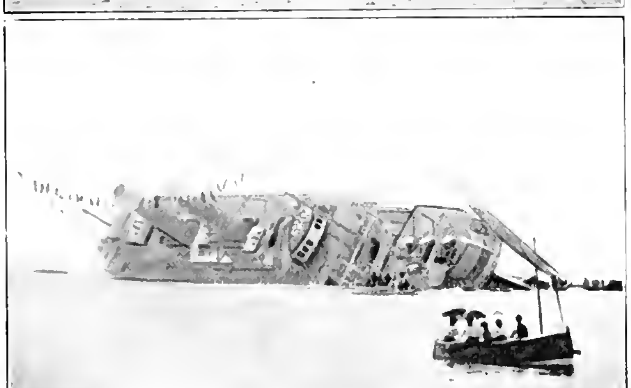
"FEPCO" HOSE.

THE "Fepco" hose is one which has its outer surface provided with a looped pile, in order to protect it from the severe wear and tear caused by dragging it over the ground and rough surfaces, and for this reason is designated a "pile-armoured" hose. The action of the pile is similar to that of the pile on a carpet, and it will be understood that so long as the pile remains intact no amount of hauling or friction will injure the body of the hose itself. It is claimed that in this way the objectionable features obtaining in wire-bound hose are entirely overcome. The hose looks a very serviceable article, and should appeal to all those who really want a hose of good durability which, at the same time, is light to handle. The sole manufacturers are Messrs. Small & Parkes, Ltd., of Manchester.

THE "RESOURCE."—This powerful steel screw tug has just been completed and shipped by Messrs. James Pollock, Sons & Co., Ltd., tug specialists, to India for service in one of the innumerable harbours dotted about the coast. She has a length of 60 ft., breadth 12 ft. 9 in. and depth 6 ft. 6 in., with compound s.c. engines and return tube marine boiler, and her trials under varying conditions were exceedingly satisfactory. She is not only fitted with one of Pollock's patent stern frames, but was so constructed that shipment was made of the tug finished complete with engines and boiler on board and ready for work, the total weight being nearly 50 tons, without the slightest difficulty or damage.



The *Baron Aberdare*, capsized in January, 1884.



Three further views of *Principessa Jolanda*.

The *Maria Rickmers*.

Photos by Henry Hughes, John Adamson & Son and Crutchlow.

MARINE ENGINEERS' QUALIFICATIONS AND SERVICE.

THE various propositions and claims which have been floating around during the past few months in connection with marine engineers, their duties and responsibilities, have excited considerable thought and discussion, and it is well that the subject should receive careful consideration from the different points of view, in order to avoid the after regrets which might follow on the adoption of regulations unsuited to attain the real end of all certificates—the test of fitness for certain work the hall-mark denoting qualifications for certain positions. Some of the propositions have obviously been launched more for the sake of educational establishments and from the point of view of the teaching element rather than that of the main question affecting the marine engineer, his immediate superiors and his employer's interests. One proposal advocated from the scholastic side gained some support for its apparent face value, but on closer investigation it was found to have objectionable features which did not appeal favourably even to some whose inclination led them towards it at first, or to those most concerned in the results, as it tended to place the theoretical side in a predominant position. It will probably be agreed by the majority that the theoretical part of an engineer's technical education requires to be made prominent, and that a good tradesman with a technical training gained through his finger ends, is all the better of having the theoretical knowledge to back it up, but the essential choice would be in favour of the good tradesman, hence the first importance attaches to the workshop training rather than to the scholastic technical education, but a combination of the two with sufficient time devoted to each is the best for all concerned—it is the most satisfactory and the most satisfying. Alterations have been proposed in the regulations to meet the cases of those young engineers who, having served the five years' apprenticeship, yet have failed to comply with the strict letter of the law in respect to minimum service in the fitting shop. It has been proposed to widen the area of workshop service and experience to embrace other departments and give time values to these. At present it is specified that three years be spent in the fitting or erecting shop, it is now proposed that two years should suffice and for this full time value be allowed; drawing office one year full time value, time beyond one year half time be allowed; pattern making, planing machine, half-time be allowed; other machines, boiler making or repairing and smith work, one-third time be allowed. Should the full five years' apprenticeship or longer be served—four years at turning followed by one year at fitting or erecting may be allowed. Technical education obtained after the age of fifteen at a Technical College or School—recognised by the Board of Trade as suitable—where there is an Engineering Laboratory, may be accepted in the ratio of three years to two in the workshop, the remainder of the time being spent in the workshop. The certificate necessary from the College or School specified is one from the Principal, but there appears one serious omission to the effect that the laboratory course and the full engineering curriculum should be taken by the candidate and such should be stated on the certificate as well as the subjects passed by him. Technical School time is not allowed to count for more than two years and foreign technical schools are not recognised. There is a further proposal that the sea going service for certificates be extended from twelve to eighteen months, on the ground that greater complications of machinery have been introduced of recent years, and that practically the duties of a marine engineer have to be learned after he goes to sea, hence twelve months' service is too short. With a view to give encouragement to junior engineers to study the theoretical side and make up for what they were either unable to acquire sooner by force of circumstances, or unwilling, by reason of sport and pastime having greater claims upon their imagination, the claims of the Technical College or School are again brought forward, and an allowance of three months of the eighteen may be accepted as valid time, if spent within two years of the date of examination at an approved Technical College or School. The proposal to extend the sea service period will probably commend itself to most engineers—outside the juniors who may not relish the idea of six months added to the period before the goal to which they look forward may be reached. It may be otherwise, however, in respect to the three months course at a Technical School, without some specific details being added to make clear what classes and certificates are to be gained by the candidate. Without some such specification the Technical School may be turned away from its legitimate service to the community, and drift into a coaching school for Board of Trade examinations. Manifestly this must be guarded against, otherwise the three months' service allowance say for a six months' course will not accomplish the ostensible end in view. The Technical School service should be defined as the full engineering curriculum and laboratory course of the Technical College or School recognised as of sufficient standing. It is more than suspected that the work done by candidates at Technical Schools is not so fully enquired into by the Board of Trade examiners as is desirable, and that students may have a name for attendances without the reality of full accomplishment of a proper course, and now that there is a proposal to further extension it is imperative that a course be defined and adhered to. Coaching for examinations cannot be looked upon as technical education, and the definition of a six months' course to be allowed to stand for three months' sea service will make clear what is expected of candidates, both as to technical education certificates and laboratory course. The Third Engineer certificate advocated some years ago by many experienced engineers and adopted in Great Britain beyond the Seas might fittingly have come up for consideration, along with the other propositions. We must safeguard the true end of training, the efficiency of the man. The success or failure of a Technical School cannot be based upon any considerations other than those which make for improvement in the mental training and qualifications of those who pass through the curriculum prescribed as fit and sufficient for the qualifications aimed at by the student and those interested in him. The school is only successful as it turns out efficient scholars, its importance and fitness can alone be gauged by the quality of the resultant; there has been a tendency among educational authorities to consider the school as an end, rather than as

a means to an end, and many of our labour difficulties have been the outcome of this reversal of the true order of things, and a perversion of the truth that the foundation is more essential to the building than the carving on the pillars.

THE STABILITY OF SHIPS.*

Having been convinced for many years that the matter of the stability of merchant ships has not received sufficient attention, I would be glad if by this paper I could assist in causing the matter to be more carefully gone into, and better understood by seafaring men. It is the duty of everyone having to do with the loading of ships to minimize as much as possible the risk to life and property involved. I am of the opinion that a considerable percentage of the vessels that have mysteriously disappeared have capsized; and I have in memory a large Atlantic liner being missing and lost with all on board; after the event a bottle was washed ashore saying that the ship was turning over. And there are not wanting records of vessels turning turtle.

In endeavouring to gauge the stability of a ship we make use of two measures. For the first 10 or 15 degrees of heel the distance between the centre of gravity and the transverse metacentre is used. This is called the initial stability or G.M. After 10 or 15 degrees of heel the statical stability should be taken into consideration. The lever of statical stability is the horizontal distance between the centre of gravity and the new centre of buoyancy, and is designated the G.Z. Initial stability, or stability at the commencement of heel, is great or small in proportion to the distance between the vertical height of the centre of gravity and the transverse metacentre. This metacentre is called transverse to distinguish it from the longitudinal metacentre, which has only to do with the longitudinal alteration of trim. The transverse metacentre is an imaginary point through which a ship rolls or heels over, and can be taken as a point of suspension below which the centre of gravity swings. The centre of gravity, of course, is the mean centre of weight of the ship and everything she has on board. As long as the centre of gravity is below the transverse metacentre the ship has some initial stability, but if it is above she is in an unsafe condition, having what is termed a minus G.M. and would not stand upright. It should be remembered that the metacentre height or G.M. is the height of the transverse metacentre above the centre of gravity, no matter where the centre of gravity is situated.

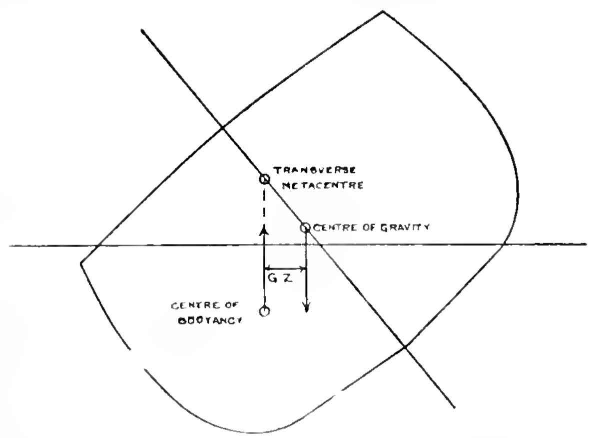
A wide water-line with a fine bottom gives a high transverse metacentre; and this with a low centre of gravity will ensure getting a stiff ship, for several degrees of heel at any rate. A large G.M. is not always desirable, as a very stiff ship is liable to be a heavy roller, for by having the centre of gravity low down a pendulum motion is set up. And yet I do not think that a small G.M. will ensure having a comfortable ship unless the weights on board are arranged in a gradual or regular manner from the keel upwards. A ship with heavy weights on her floor and others near the uppermost deck might have a small G.M., but these weights would act as pendulums and cause great rolling.

The metacentre should never be less than nine inches above the centre of gravity, but its height should be arranged to suit each particular class of vessel. A ship with a large free-board should have a large G.M. to minimize the danger caused by a large area of side being exposed to squalls or heavy seas; see accompanying calculation. A shallow vessel with low free-board should also have a large G.M., because after her deck at the lee side becomes submerged she quickly loses her stability. The G.M. is generally taken as remaining unchanged for the first 10 or 15 degrees of heel. After that the water-line generally becomes wider and the metacentre rises. This is what makes a top-heavy ship rest on one side, because a ship with a minus G.M. will heel over until the centre of gravity and new metacentre coincide.

The height of the metacentre is calculated from the offsets of the water-line. The method of calculating is given later. The G.M. can be obtained by an inclining experiment which is shown following the calculations for the metacentre. The method of arriving at the G.M. by calculation is next shown. It is an easy calculation by moments, but one should be very careful, as the draught, centre of gravity and metacentre are always changing.

The beam in relation to depth is an important factor in the stability of a ship. A rough guide in designing a ship with all weights normal would be to have the greatest midship depth of a small vessel ·5 of the beam and gradually increased up to ·7 in a very large vessel. Vessels with very high top sides, such as American river and coasting steamers, which have two or three decks above the water, are very misleading to amateur students of stability. These vessels have a very great beam and extremely light upper works, or they could not stand upright. The G.M. is a splendid guide to a ship's stability, even though nothing is known about her righting power when considerably heeled over. It is not wise to cut down the G.M. to the fine point for the sake of a comfortable movement. There should always be some reserve stability in case of a breakdown in a heavy seaway, when a ship would get into the trough of the sea and easily be capsized; and besides, you cannot always foresee what a tender ship would do if an accident should cause a large inrush of water on board.

Statical Stability.—After 10 or 15 degrees the statical stability can be reckoned as the gauge of a ship's stability. As the ship heels over the centre of buoyancy travels to the lee side, and by its pressure being upwards it tends to right the ship. But after a certain inclination the centre of gravity gets as far to the lee side as the centre of buoyancy, at which



point the ship has no power to right herself. This point is called the vanishing point, the stability vanishing here. The horizontal distance between the centre of buoyancy and the centre of gravity, when the centre of buoyancy is at the lee side of the centre of gravity, is the righting lever, and this distance in feet multiplied by the displacement in tons is the righting moment or the moment of statical stability in foot tons. (See sketch). Statical stability is found by a long calculation, and errors are liable to creep into it, but there are several methods of finding it by models. Barnaby's approximate method, which is described further on, is very good, and very simple to carry out. In reckoning the position of the vanishing point it should be remembered that if there is any loose cargo on board it would begin to run to leeward after a certain inclination and thus decrease the range of stability.

Dynamical Stability is another expression of a ship's stability which I shall not deal with here, except by saying that it is the measure of the work done in putting a ship over to any angle of heel, and is the difference between the vertical distance from the centre of buoyancy to the centre of gravity in an upright position and at the angle of heel. The centre of buoyancy is depressed and the centre of gravity is raised as the ship heels over.

Barnaby's Approximate Method of Finding a Ship's Statical Stability.—Divide the length of the ship into any convenient number of equal parts. A large number of divisions is better than a small number. Cut out cross sections in thick paper representing the underwater part at each of

*Read at a meeting of the Institute of Marine Engineers, by Mr. Edwin Tate (inventor of the Patent Stability Indicator).

these divisions, at say 15° of heel. Gum these sections together, with the centre line of ship and water-line coinciding in each case. If this paper model is suspended at two or three different points, plumb lines from each will cross at a point which is the centre of gravity of the paper model, and is in the same position as the centre of buoyancy of the ship at 15° of heel. As the ship heels over the waterline will probably either rise or fall, so that the sections should be made with a good margin above the water-line to allow of making this correction. A set of sections should be made at the upright position and gummed together; the weight of this will represent the displacement of the ship, and the paper model of 15° heel should be reduced by cutting off parallel strips at the water-line until the weight is the same as that of the upright position. The horizontal distance between vertical lines drawn through the new centre of buoyancy and the centre of gravity is the length of the righting lever or GZ. If this process is repeated for, say, every 15° of heel a curve of righting levers can be drawn from the models.

PRESSURE OF WIND ON THE TOPSIDES OF A SHELTER DECK STEAMER, 460 FEET × 58 FEET × 34 FEET, LOADED.—Mean draught, 27 feet; displacement, 16,200 tons; G.M., 2 feet; greatest righting lever or G.Z., 2 feet, at 45° heel in this case. Exposed topsides 10,660 sq. feet × ·75 on account of ship's form = 8,000 sq. feet.

Wind pressure allowed for on bridges, etc. = 56 lb. per square foot. Distance of centre of topsides above centre of lateral resistance = 25 feet. 8,000 square feet × 56 lb. = 200 tons. 200 tons × 25 feet = 5,000 foot tons wind pressure. This will heel the vessel over 9°.

Disp. × G.M. × tan 9° = 5,120 foot tons.

PRESSURE OF A CURLING WAVE 30 FEET HIGH OF THE SAME VESSEL.—Greatest pressure of a 30 feet wave = 1 ton per square foot. 8,000 square feet × 25 (lever) × 1 = 200,000 foot tons, total pressure of wave. Greatest righting moment of ship = 16,200 (disp.) × 2 (lever) = 32,400 foot tons or $\frac{1}{6}$ the power of the wave on the ship's side.

It is very unlikely that a wave would strike the whole side at once.

METHOD OF CALCULATING HEIGHT OF TRANSVERSE METACENTRE.

Water-line 6 feet above keel. Ordinates 13·5 feet apart.

	Ordinates = $\frac{1}{2}$ width of water line.	Cubes of ordinates.	Simpson's multipliers.	Functions of ordinates.
0	·0	0	1	0
1	2·25	11	4	44
2	8·0	512	2	1,024
3	13·1	2,248	4	8,922
4	16·0	4,096	2	8,192
5	17·6	5,452	4	21,808
6	17·85	5,687	2	11,374
7	18·1	5,930	4	23,720
8	18·2	6,029	2	12,058
9	18·2	6,020	4	24,116
10	18·2	6,029	2	12,058
11	18·2	6,029	4	24,116
12	18·2	6,029	2	12,058
13	18·2	6 029	4	24,116
14	18·0	5,832	2	11,664
15	17·7	5,545	4	22,180
16	17·1	5,000	2	10,000
17	15·5	3,724	4	14,896
18	11·5	1,511	2	3,022
19	5·5	166	4	664
20	·0	0	1	0

			246,032
Displacement	1,082 tons	$\frac{1}{3}$ interval	× 4·5
	× 35		
do. in cub. ft.	37,870		1,107,144
		2 sides	2
			3)2,214,288
			37,870)738,096(19·49

Transverse metacentre 19·49 feet above Centre of Buoyancy.
Centre of Buoyancy 3·41 ,, ,, top of keel.

Transverse metacentre 22·9 ,, ,, ,, ,,

If the height of the centre of buoyancy is not known it can be closely approximated by multiplying the mean draught above top of keel by ·53 in full ships, to ·58 in fine ones.

METHOD OF CALCULATING THE HEIGHT OF CENTRE OF GRAVITY OF A LOADED SHIP, AND SHOWING THE AMOUNT OF G.M.

	Tons.		Height of centre above base in feet.		Moment ft. tons.
Displacement of ship light	4,600	×	22·0	=	101,200
Cargo in lower holds	5,000	×	14·7	=	73,500
,, 'tween decks ..	2,000	×	28·5	=	57,000
Coal in bridge bunkers ..	800	×	37·5	=	30,000
Cargo in poop	200	×	39·0	=	7,800
Total displacement at 25 ft. draught	12,600				269,500

269,500 ÷ 12,600 = 21·4 ft. = height of centre of gravity loaded.
Height of transverse metacentre at 25 ft. draught = 22·5 ft.
,, centre of gravity loaded ,, ,, = 21·4 ,,

G.M. = 1·1 ft.

Any number of weights put on board can be treated in the same way, and the mean centre of gravity obtained.

Working by moments in above manner is very much resorted to in shipbuilding calculations.

The centre of gravity of ship light can be closely calculated by taking each part of the ship separately and multiplying its weight by its height, adding up the moments and dividing the total by the total weight.

The fore and aft centre of gravity can be found in the same way, only measuring from a point at either end of the ship in a horizontal direction instead of vertical.

TO ASCERTAIN THE G.M. BY INCLINING EXPERIMENT.

Use about 3 tons of inclining weights for every 1,000 tons displacement; but as the G.M. at the commencement of heel is required, the ship should not be heeled more than two or three degrees.

1. Having fixed a plumb line at centre of ship with bob free to swing, put half of the inclining weights at each side of deck, the ship being upright.

2. Place all the inclining weights at one side and measure the distance the pendulum has moved.

3. Carry all the weights to the opposite side of deck and again measure the movement of the pendulum.

Then A = Inclining weights in tons.
B = Distance in feet weights are moved across deck.
C = Length of pendulum in feet.
D = Displacement of ship in tons.
E = Distance pendulum moves in feet.

$$\frac{A \times B \times C}{D \times E} = \text{G.M. in feet.}$$

A correction has to be made on account of heeling weights being placed on deck.

Loose water on board destroys the exactness of the experiment, but this can be allowed for by treating the water as an inclining weight, reckoning for the distance it moves, the same as is done for the other inclining weights.

EXPLANATION OF THE INCLINING EXPERIMENT.—When a weight is moved in a thwartship direction across a ship the centre of gravity of ship is moved a distance that can be calculated by moments, as previously described. The ship heels through a certain angle when the weight is moved. Now the point wehre a ve tical line from this new centre of gravity cuts the centre line of ship, or a vertical line above the original centre of gravity, is the transverse metacentre. The G.M. bears the same proportion to the distance the centre of gravity moves as the length of pendulum does to the distance the plumb-bob moves. If the distance the centre of gravity moves is multiplied by the cotangent, or divided by the tangent of the angle of heel, it will give the G.M. Both this and the calculation of moments are included in the formula previously stated.

CORRECTION FOR HEELING WEIGHTS.—If these weights have raised the centre of gravity of the ship, which can be

calculated by moments, add the amount to the G.M., and if the transverse metacentre is lower at the increased draught caused by the weights being placed on board, also add the amount to the G.M. and *vice versa*.

That the foregoing calculations for height of centre of gravity and metacentres and the system of gauging a ship's stability by metacentric height are quite reliable, has been proved by long experience. The writer has often had occasion to estimate the effect of alterations and ballasting, and in every case the heeling experiment has shown the effect to be the same as estimated.

THE "ODDIE" SIMPLEX AIR PUMP.

THE demand for a really first-class independent direct-acting air pump which is capable of maintaining a high vacuum, and at the same time be of moderate weight and occupy small space, has been little beneficial result, and attempts have been made to solve the problem by the introduction of a double-acting vertical air pump; but in this latter case departure has been made from the type of pump which has proved itself by long practical experience to be most efficient for marine use, namely, that in which foot, bucket and head valves are used.

With an ordinary single-cylinder pump of the three-valve type with a direct-acting steam cylinder, if it is to work under all conditions reliably and smoothly, difficulties are encountered which are not easily overcome; and, further, such pump has the drawback that the vacuum fluctuates owing to the fact that there is but one suction stroke per double stroke of the pump.

The Oddie Simplex Air Pump, which we illustrate in the adjoining diagrams, has been designed to solve

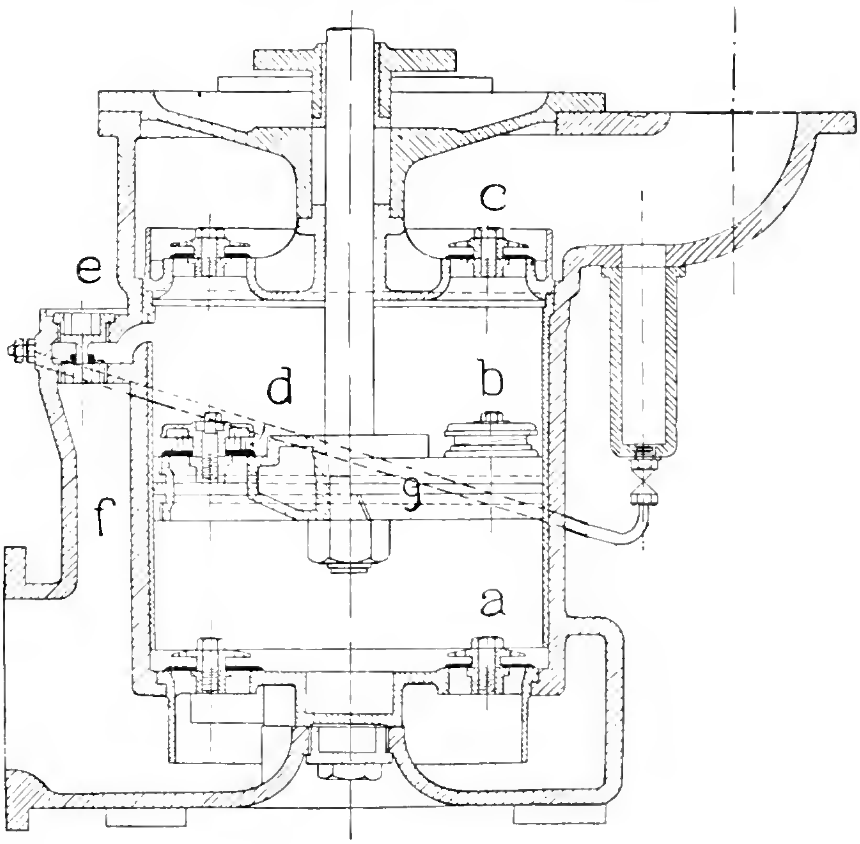


Fig. 1.

created by the introduction of the steam turbine for ship propulsion. As soon as it was appreciated that the steam turbine depended for its economy on the maintenance of a high vacuum efforts were made to modify the construction of air pumps.

It has been found that the ordinary type of air pump used for reciprocating engines, when modified to suit the requirements of turbine machinery, not only assumes a great bulk and attains great weight, but owing to these features considerable difficulty is found in finding a place for it in the engine-room, and to such extent that much of the advantage of weight and space claimed for the turbine is neutralized. Twin independent air pumps have been made, but with the difficulties of the above problem, and to provide a vertical air pump which is only about half the weight of the ordinary twin-beam pump, and occupies only half the space, while at the same time attaining all the known advantages of the three-valve type.

The air pump illustrated in section in Fig. 1 is fitted with foot valves **a**, valves in the bucket **b**, and head valves **c**. It differs, however, in a very marked manner from the ordinary type by the fact that the air and vapour are drawn in during a considerable portion of the downward stroke. This takes place in the simplest manner and without any complication, so that the full advantages of the three valve type attain their utmost development and highest use. The

valves in the bucket are loaded with springs **d** so that they do not open till there is a pressure of about 4 lbs. absolute on the underside of the bucket. On the other hand the foot or suction valves **a** are very light and open under the slightest pressure. Besides these foot or suction valves, which control a passage leading to the suction chamber, one or two auxiliary suction valves **e** are provided for the purpose of controlling the passage **f**, which leads from the suction chamber into the upper extremity of the pump cylinder or barrel. These auxiliary suction valves **e** are so constructed that they open to the very lightest pressure.

As the bucket **g** ascends, the foot valves **a** open and admit air, vapour and water from the suction chamber in the usual way, whilst the contents above the bucket are discharged through the head valves **c**, also in the usual way. When the piston descends, there is a diminution of pressure between the head valves and the piston, and an increase of pressure between the valves in the piston and the foot valves. In the ordinary pump of this type, this increase of pressure below the piston causes the valves in the piston to open directly after the commencement of the down stroke of the piston.

In the "Oddie" Pump, on the contrary, where the valves **b** are loaded with springs, the opening of the said valves is delayed until the pressure exerted by the fluid compressed below the piston overcomes the resistance of the springs. A very slight reduction of pressure above the bucket suffices to open the auxiliary suction valve **e**, when air is drawn from the suction chamber or the condenser to the upper part of the barrel. The admission of air through the valve continues until the fluid is so far compressed under the piston as to offer sufficient resistance to cause the valves in the bucket to open.

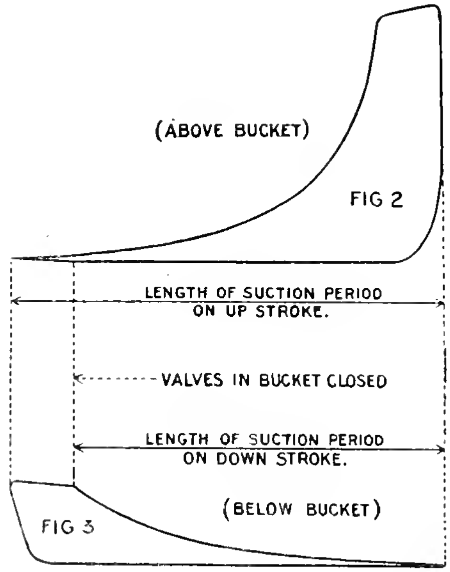
The accompanying diagrams, Figs. 2 and 3, demonstrate that the result of the "Oddie" System is the increase of the suction period to nearly double, that is to say, that here, with one cylinder, the same delivery and exactly the same manner of working is attained as elsewhere with double cylinders and pistons connected by beams.

Figs. 4 and 5 are diagrams showing the gain of volume displaced in the "Oddie" Pump and that of an ordinary three-valve pump. These diagrams are taken from above the piston, that is to say between the valves in the piston and the head valves. Both are taken from the same pump under as nearly as possible the same conditions; but in the second case the additional suction valves were closed and the strong springs removed from the valves in the piston, the speed being precisely the same, *viz.*, 50 in both instances.

Thus in the second case the pump was working as an ordinary three-valve air pump. The extra work performed by the "Oddie" Pump compared with that of the same sized ordinary three-valve air pump is, we understand, shown to be rather over 1·7 to 1, which corresponds exactly with the theoretical considerations.

The difficulty of driving a single-cylinder air pump by a direct-acting steam cylinder, without a crank to limit the exact length of stroke, and without flywheel to equalize the difference of work performed in the up and down stroke, and during the stroke, will be at once appreciated by those acquainted with the limitations of the ordinary direct-acting steam cylinder, on reference to diagrams in Figs. 2 and 3.

The "Oddie" Patent Simplex Steam Gear controls the steam during the up and down stroke so that the pressure in the steam cylinder corresponds with the



work done in the air-pump cylinder throughout the whole double stroke. Further, the steam pressure in the cylinder for the upward stroke may be, say, 10 Atms., and the quantity of steam at this pressure admitted during the upward stroke is regulated to suit

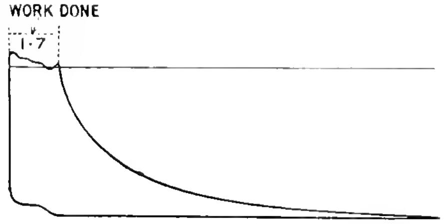


FIG 4

the increase of work done as the stroke proceeds; whilst the pressure in the cylinder for the down stroke may be but 1 Atm., which will be admitted in the correct quantities for the work to be done on the down stroke, the result being that the piston travels at perfectly equal and even strokes throughout the whole cycle.

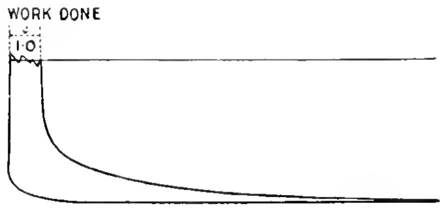


FIG 5.

This new distribution of steam is accomplished with only one valve. Fig. 6 shows this valve, the caps surrounding the ends of it, and the lever and rod which operate it. This single valve performs a triple function:—

1st. It acts as a main distributing valve for controlling the channels leading to the ends of the cylinder, and reversing these at the end of the stroke;

Fig. 6.

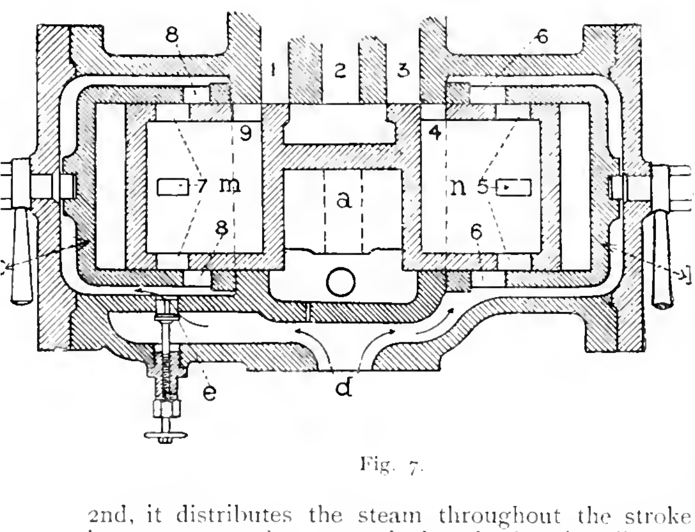


Fig. 7.

2nd, it distributes the steam throughout the stroke in exact proportion to work done in the air cylinder: 3rd, it acts as its own auxiliary valve, reversing the auxiliary channels, which causes the valve to be thrown over completely, as soon as, but not before, the main piston has finished its stroke.

Fig. 7 is a sectional plan through the valve chest with valves and caps in position. **a** is the main valve. **b** and **c** the right and left-hand caps respectively. Steam enters at **d** and passes freely to the right hand side of the valve chest completely surrounding the cap **b**. By opening the throttle valve **e** it can also pass to the left-hand side of the valve chest in a more or less throttled condition.

In operation, starting the piston at the bottom of the stroke, the valve will be at its extreme left-hand travel, and the main channel **1** communicating with the upper part of the steam cylinder will be open to the exhaust port **2**, whilst the main channel **3** communicating with the lower end on the steam cylinder, will be open to the right-hand interior chamber **n** of the main value **a** by means of the port **4**. The small ports **5** in the main valve will now correspond with the small ports **6** in the cap, steam in small quantities will therefore be admitted under the piston which will commence to ascend, carrying the piston in the air pump with it. As the piston ascends, the valves receive a slight turning motion which continues throughout the stroke. This turning motion increases the area of the port opening for the entrance of steam into the chamber **n** of the main valve, thus the steam pressure acting on the piston increases in direct proportion to the increase of air pressure in the air pump. Just before the end of the stroke the slow turning motion is accelerated, reversing the auxiliary channels (not shown) thus causing the valve to move completely to its right-hand extreme position.

The main channel **3** is now open to the exhaust, whilst the channel **1**, communicating with the top of the steam cylinder, is open to the interior chamber **m** on the left hand of the main valves. The small openings **7** in the main valve now correspond with the opening **8** in the left-hand cap. As now underneath the air-pump piston a vacuum approximately equal to the vacuum in the condenser is present, if the full pressure of steam were allowed admission to the upper part of the steam piston, the piston would descend with a velocity and force equal to a steam hammer.

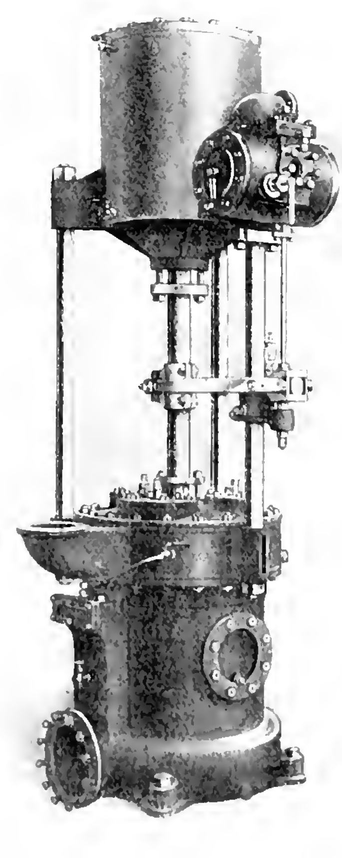


Fig. 8.

In the "Oddie" gear, however, only the minutest quantity of steam is allowed to enter, it being under complete control by means of the throttle valve **e**. The piston descends at a uniform rate, the circular motion given to the valve increasing the admission as the contents of the air pump under the bucket valves is compressed. Before the end of the stroke the steam is cut off altogether by the further circular motion, and the piston brought quietly to rest.

It will be seen that the steam is under complete and independent control, both on up and down strokes; the positions of the caps are adjusted by the handles outside. When once properly adjusted, these do not need to be altered; the only regulation after turning on the steam being performed by the small throttle valve.

When starting with no vacuum in the condenser and the condenser full of water, this throttle valve should be fully opened, and as the vacuum increases should be gradually closed until it is observed that both the up and down strokes are perfectly even and both travelling with the same velocity.

The main valve is an ordinary D valve, but without the wear and tear that an ordinary D valve is subject to, since it is exposed only to highly throttled steam, the pressure being such as to hold the valve securely up to its face without undue wear and tear. This throttled steam is also used for reversing the main valve. Any wear on the valve face, which is, however, infinitesimal, owing to the small pressure to which the valve is exposed, is automatically taken up by the valve itself without affecting the action of the valve in any way, the caps, being in perfect equilibrium, adjust themselves automatically to the position of the main valve on its seat.

Fig. 8 shows a Single-Cylinder "Oddie" Air Pump as supplied to the Imperial German Navy, as an independent air pump in connection with steam turbines, from which the simplicity of this pump, when compared with the twin-clyinder beam pump, is most strikingly apparent. The pump is also fitted on the Hamburg-American liner, *Cleveland*. The pumps are placed on the market by Messrs. Lee, Howl & Co., Ltd., of Tipton and London, who are the sole licensees for Great Britain and the British colonies.

TRIALS OF THE "SAO PAULO."

THE trials of the Brazilian battleship *Sao Paulo*, which has been built and engined by Vicars' Company at Barrow-in-Furness, were completed about the end of May, and with eminently satisfactory results. All the trials were run on the Clyde, prior to which the vessel was dry-docked at Liverpool. They were supervised by the Brazilian Naval Commission, under the presidency of Admiral Bacellar, and in some respects were of a more severe character than those prescribed for ships built for the British Navy.

The series of speed trials were run on the Admiralty measured course at Skelmorlie. During the forty-eight hours' trial, which was taken to determine the coal consumption at cruising speed, the vessel ran at an average speed of 10·6 knots and the engines showed 2,383 i.h.p. The coal consumption was so satisfactory that it would admit of the ship having a radius of action of 12,913 miles, which is 2,913 miles in excess of that stipulated in the contract. The thirty hours' trial was run at three-fourths speed, and the final results showed that a speed of 19·85 knots had been attained with the engines developing 17·377 i.h.p. On the full-speed tests the vessel attained 20·99 knots, and for the six runs on the measured mile the figures were mean speed 21·23 knots with 25,577 i.h.p.

According to the contract two extra runs had to be taken over the measured mile in order to determine the highest possible power which could safely be developed, and it was then found that the power was 28,645 i.h.p. and the speed 21·623 knots. Some of the latter trials were run under anything but ideal conditions, half a gale blowing on one of the days.

The gun trials were all gone through most successfully, including the one great test of firing ten 12-inch guns electrically at the same moment. The concussion was very great, but the vessel only heeled some five degrees. The *Sao Paulo* is 500 feet long, 83 feet beam, with a draught of 25 feet and a displacement of 19,280 tons. She is heavily armed, having twelve 12-inch guns, twenty-two 4·7-inch guns, as well as a large number of 3-pounders.

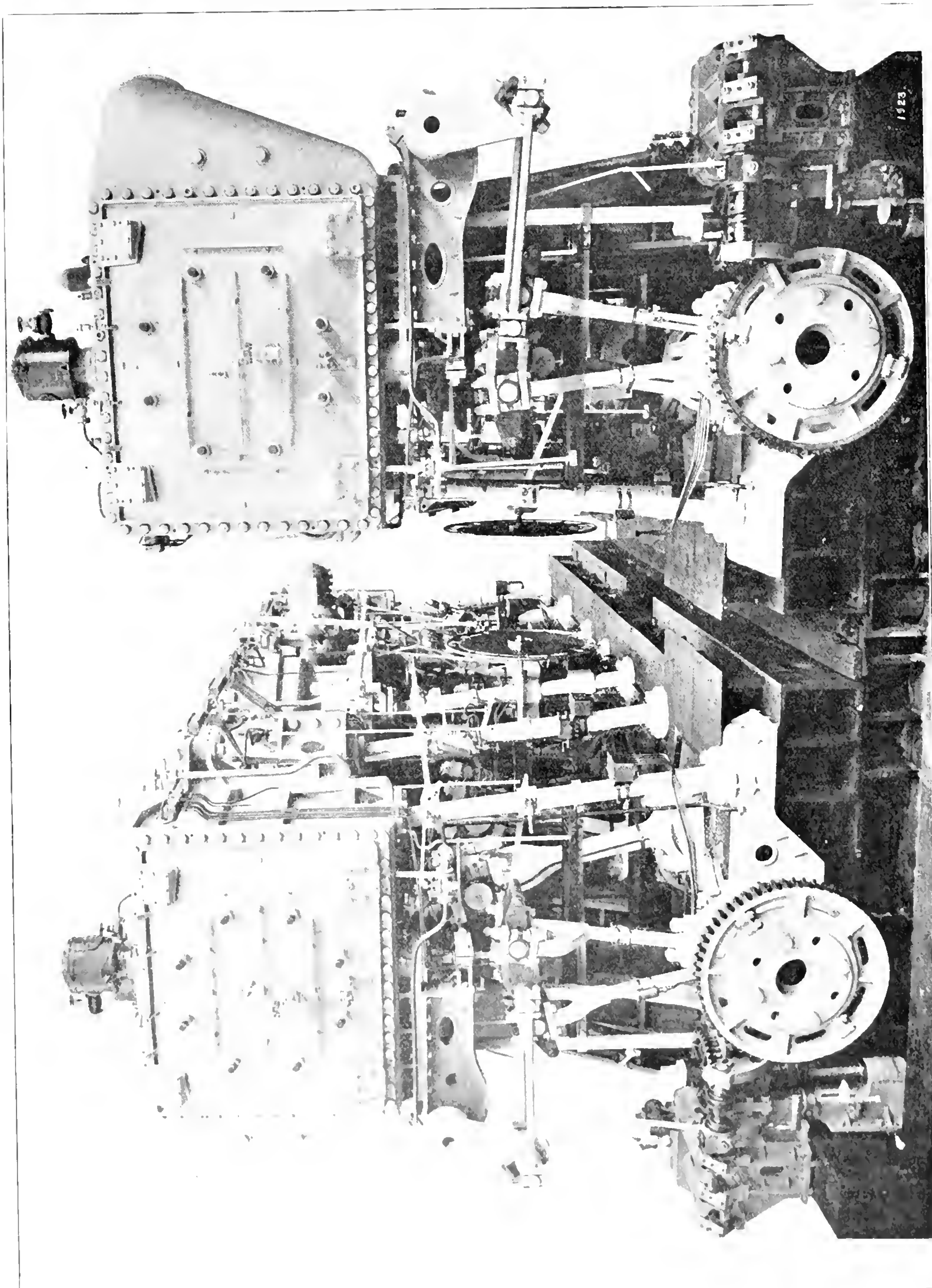
THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Shipping Deal.

THE latest purchase by the Board of the Royal Mail Company will place that organization in the front rank of British shipping Companies, both as regards amount of tonnage held and as regards importance in the number and character of its services. The news that the Royal Mail Company had made an offer to the Chairman of the Pacific Steam for the purchase of the ordinary share capital and that that offer was provisionally accepted came as a great surprise. For it was only a few weeks ago that at the annual general meeting of the Liverpool Company it was explained by the chairman, how, owing to the changing conditions brought about by the development of railway facilities in South America, and especially by the opening of the Transandine Railway, it would be necessary for them to act on the powers already entrusted to them and to build important vessels for their mail service with a view of retaining and extending their hold on the passenger service. Soon after the meeting had been held tenders for the construction of one or two large vessels of a length of 600 ft. and presumably of about 14,000 tons gross register, were invited. Then came the news of the deal. The issued capital of the two Companies seems to be :—Royal Mail, £900,000 Ordinary and £600,000 Preference Stock, whilst there is also an issue of a million sterling debentures, so the total is two and a half millions. The Pacific Steam Navigation Company has no debentures, the issue authorised by the shareholders for the purchase of new steamships to which I have alluded having been delayed. Its share capital is slightly under a million and a half. The United Company will thus have a fleet of not far short of 400,000 tons of shipping, and a capital of about four millions sterling, with power of issuing further debentures on account of each of the constituent Companies.

There have previously been deals between these two Companies, notably that whereby the Royal Mail took the place of the Pacific Steam as partner with the Orient Company in the fortnightly service between London and Australian ports, and at the same time purchased the vessels which the P.S.N. had allocated to that service. As will be remembered, the Royal Mail Company gave up its share in this adventure when the new contract with the Dominion Government came into force, and now the Orient Company is alone in the service for which it has built so many new vessels.



Engines of the Brazilian Battleship "Sao Paulo."

This development, like others which have taken place in the recent history of the Royal Mail Company, is due to the energy of the Chairman, Sir Owen Phillips. I was looking at some old papers a day or two ago and noticed that, as recently as the year 1901, its fleet only totalled some 88,000 tons. Now, as I have said, it amounts to about 400,000 tons. Leaving out of our view for a moment the fine twin-screw mail steamers which it is acquiring from the P.S.N., it has added during this period such vessels as the *Amazon*, the *Araguava*, the *Aragon*, and, last and largest of all, the *Asturias*. All these big twin-screw mail steamers have been built at Belfast—one, I think, by Messrs. Workman, Clark & Co., and the others by Messrs. Harland & Wolff. The interest which it acquired in the Shire Line has given the Company connections with the Far East. The purchase of the Forwood Line has opened up to it the tourist and cargo traffic to North-West Africa and the islands, whilst Sir Owen Phillips himself has of late interested himself with Lord Pirrie in the new Elder, Dempster & Co., Limited, which consolidated and acquired the far-reaching businesses which had centred in the office of the late Sir Alfred Jones.

One must assume, from the terms of the deal, that the Royal Mail will be the preponderating partner in the new organization; indeed it is evident that it is more than a partnership. It is an absorption. This being so it would appear to be another gain to Southampton and London at the expense of Liverpool. For seventy-one years, the headquarters of the Royal Mail Company, as regards its official work, has been in London, whilst Southampton has been the terminus of the more important of its services. The Pacific Steam Navigation Company—which, like the Royal Mail is a chartered Company, and of only a few months less seniority—on the other hand, has made the Mersey its home throughout its career. It is said, of course, that no change will be made in the headquarters of the steamers which are to be taken over from the Pacific Steam. But the main direction of what was a Liverpool Company, built up by Liverpool capital, Liverpool connections and Liverpool brains being removed to the capital, its essentially Liverpool character will be destroyed, even if the actual ships remain in the Mersey.

Amalgamations seem to be the order of the day. For it is stated that the well-known Russian Volunteer Fleet is about to absorb the East Asiatic Company, which—trading outside the limits suggested by its title—maintains a service between Libau and New York, as well as that to the Far East. The Company which will thus merge its identity, was the owner of the large steamship *Korea*, which was abandoned in the Atlantic in March of the present year, her crew being taken off by the Anchor Line express steamer *Caledonia*, and which two days after abandonment, being of course without lights, was run into by the Allan Liner *Ionian*. This collision caused the British vessel some damage—fortunately above the water line.

The Royal Line

seems to be taking its place amongst the great Atlantic Companies. Lord Grey, the Governor-General of Canada, travelled to England by the *Royal George* on her first eastward passage, making the run from Rimouski to North Point in six days two hours. This vessel brought the mail under arrangement with the Canadian Government, whereby a fortnightly despatch is to be made by the steamships of this line. Meanwhile, running to the westward, the *Royal Edward* was making a record time to the St. Lawrence. She was reported as off Farther Point at 6 a.m. on the 15th June, which made her time from Bristol only five days nine hours and thirty minutes. This is equivalent to a passage of five days seventeen-and-a-half hours to Quebec, and puts her present trip as thirteen hours better than that which she herself previously made.

Disasters.

The wreck of the *Pericles* altered its position during a gale in the first part of May, for the lighthouse keepers at Cape Leuwin reported that about six feet of one of her masts was showing. This goes to prove that the vessel must have righted herself under the influence of the heavy weather which she has experienced even at the depth of sixteen fathoms in which she lies. Two salvage steamers had been at work on her and recovered a quantity of miscellaneous effects. But their report to the effect that cargo was floating for miles along the coast would seem to indicate that the ship was beginning to break up.

Parliament and Shipowners.

The extent to which certain classes of Members would have Parliament interfere with the business of the shipowner is indicated by a question which was addressed to Mr. Sydney Buxton as President of the Board of Trade the other evening. It was alleged that certain painting work aboard one or more steamships of the White Star Line had been carried out by some of the stewards, and it was suggested that the Board of Trade should interfere and stop the practice. The ground on which such interference was sought seems to be that if the stewards were engaged on such work, the paint which they had been using might affect their hands and clothes, and so taint the food of the passenger. The mind which conceived this point seems to have ignored the fact that even those painters who are regularly employed as such have a domestic side to their lives. Moreover, in his answer to the inquirer, the President of the Board of Trade was able to give the assurance that this painting was not done when the men were acting as stewards. Strange as it may appear to a Member of Parliament, exactly the same number of passengers is not always carried by a steamer, and it may be that a large number of people are travelling in one direction at a time when business in the other is comparatively slack. A staff equal to the duty of attending on the larger number has to be carried both ways, and what more natural than to find employment in rendering pleasant and sanitary the unoccupied accommodation by that part of the staff which would otherwise be idle. A steward is technically a seaman, and from time immemorial it has been part of the duty of the seaman to paint his ship. It is, of course, only of recent years that the force of stewards has come to outnumber the various classes of navigators. But the historic fact that seamen always have painted their ship would seem to provide an answer to any objection that might be made on the ground that this employment was an infringement of the painter's proper sphere.

Tourist Steamships

seem to be unlucky! For several accidents have of recent years been chronicled, in spite of the fact that their numbers are so few. This is probably due to the fact that, whereas the liner follows the same path voyage after voyage—though as we have seen in the case of the *Pericles* this fact is not always a guarantee against uncharted dangers—the tourist vessel makes her way into places where there is no inducement for commercial vessels to venture. The latest example of accident to a public yacht is the stranding in Geiranger Fjord of the Polytechnic Association's *Viking*. The incident does not seem to be a serious one, but it reminds one of the fact that this vessel, under the name of *Viking*, conceals the identity of a famous old mail steamer. She was built at Clydebank in 1881 and under her original name of *Moor* was for a time the crack vessel of the old Union Line to the Cape. Not only as a mail steamer, but also as a transport, she did much public service. Then, after being lengthened in 1894, she was transferred to the fleet of the Royal Mail Company, assuming for a time the name of *La Plata*, which throughout the history of that line has generally been borne by a crack ship. Being cast from that fleet, she became a tourist vessel, and a couple of years ago took the name of *Viking*.

Developments at Fishguard

seem probable, for dredgers are busily engaged night and day at the port in the vicinity of the quay, and it is said that the outward-bound steamships of the Cunard line—or at least some of them—will commence calling there. At all events as a homeward port of call the place seems to give the utmost satisfaction.

Combination Engines.

The mixed installations of reciprocating and turbine engines fitted in the New Zealand Shipping Company's *Otaki* by Messrs. Denny's, of Dumbarton, have given so much satisfaction that several other vessels are being engined

on the same plan. Not only is the new steamer *Rotorua* of the New Zealand Company so fitted, but it has been determined that the new Orient liner recently ordered of Messrs. John Brown, of Clydebank, is to be engined on this plan, as well as one of the two steamships now under construction for the Aberdeen line. The last-named Company is building two new steamships. One, to be named the *Themistocles*, is ordered to replace the lost *Pericles*, and the other, the *Demosthenes*, will take the place of the *Damascus*, recently sold out of the fleet to Italian shipbreakers. The two vessels are to be practically sister ships, save that the *Themistocles* is to be a twin-screw with ordinary reciprocating machinery, whilst the *Demosthenes* will have a third shaft with a low-pressure turbine. Excellent opportunity will thus be given for comparing the relative efficiency of the two methods of propulsion. In mentioning these ships one should, for the sake of completeness, remember that one of the White Star Dominion liners, the *Laurentic*, has a low-pressure turbine, and it is believed that the gigantic vessels now building for the White Star Line's New York service by Messrs. Harland & Wolff will be similarly equipped.

The Post Office and the Shipowner.

In the House of Commons the other evening Mr. Norman Craig called attention to a serious blot of the management of the Post Office. Important telegrams relating to the stranding of the Atlantic Transport Company's steamship *Minnehaha* were received at the General Post Office in London on the morning of Sunday, the 24th April. But owing to the regulations, delivery was not made to the addresses, the Managers of the Company, till the next day. The importance of such telegrams should be apparent even to Government officials, and it is obvious that a delay of twenty-four hours in the receipt of such news as that of this stranding might have meant the loss of hundreds of thousands of pounds to those concerned. It appears that there is some regulation of the department to the effect that telegrams are not delivered to City business houses on Sundays unless notice of a desire to have them is filed at the Post Office. The Atlantic Transport Company had not given such notice—perhaps they were unaware of the regulation, for whose existence there can be no justification. There are those who would minimise Sunday work, and it may be right to allow such persons to give notice to the Post Office that they do not desire to have their telegrams on Sundays. But it is absurd that the presumption should be the other way. Mr. Norman Craig does not seem to have succeeded in having the regulations put on a sensible footing—that would be expecting too much, but he obtained a promise that, where the contents suggest urgency, delivery shall be made. And so in the future, if some unknown official deigns to think the message of sufficient importance, it *may* be delivered.

THE PORHYDROMETER.

WE understand that the progress being made by the new Company lately formed to exploit the patent Ships' Cargo Weighing Machine "Porhydrometer" is very satisfactory. The machine is being favourably taken up and proving its extreme usefulness. Not only are shipowners recognising it, but the merchants and dealers are accepting the weights.

The Denaby and Cadeby Main Collieries, Ltd., have now had a second vessel fitted and are selling their bunker coals to vessels regularly by porhydrometer weight. Quite a number of orders and enquiries are coming in, and there seems every prospect of the machine becoming a usual and indispensable part of the outfit of cargo-carrying vessels.

The Company have within the last few weeks fitted out a large grain-carrying steamer for the Canadian lakes, a coasting steamer of about 800 tons, a large collier of 4,000 tons and several barges, and have at present in hand installations for a large 6,000-ton iron ore carrier, two colliers and a number of barges for various purposes.

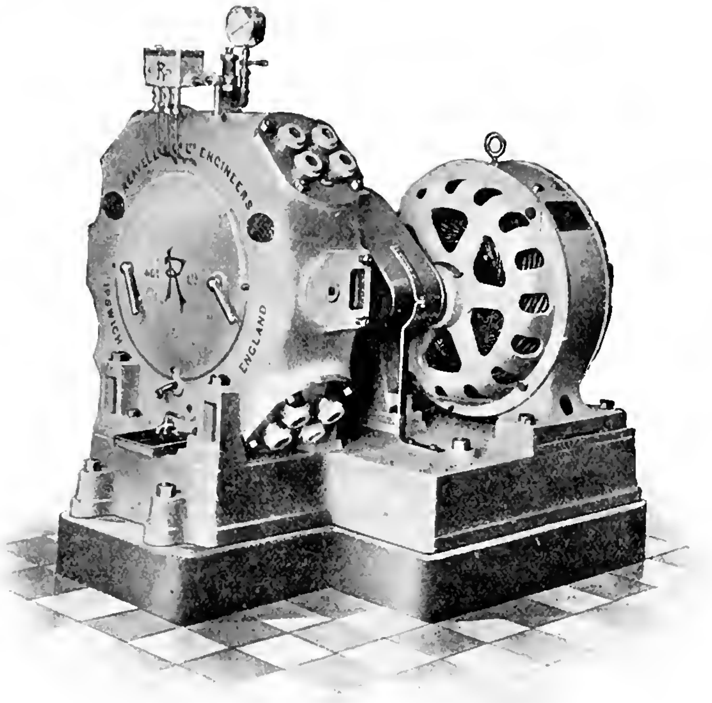
THE BRUSSELS EXHIBITION.

THE engineer who goes to the Brussels Exhibition solely with the idea of seeing the latest phases of marine practice will probably come away disappointed; but he who does not desire a merely spectacular display, but will make a careful study of the models and various auxiliary machinery, will find much to reward him. Before, however, proceeding to detail it will be as well to briefly review the scope of the Exhibition and the representation of the various countries.

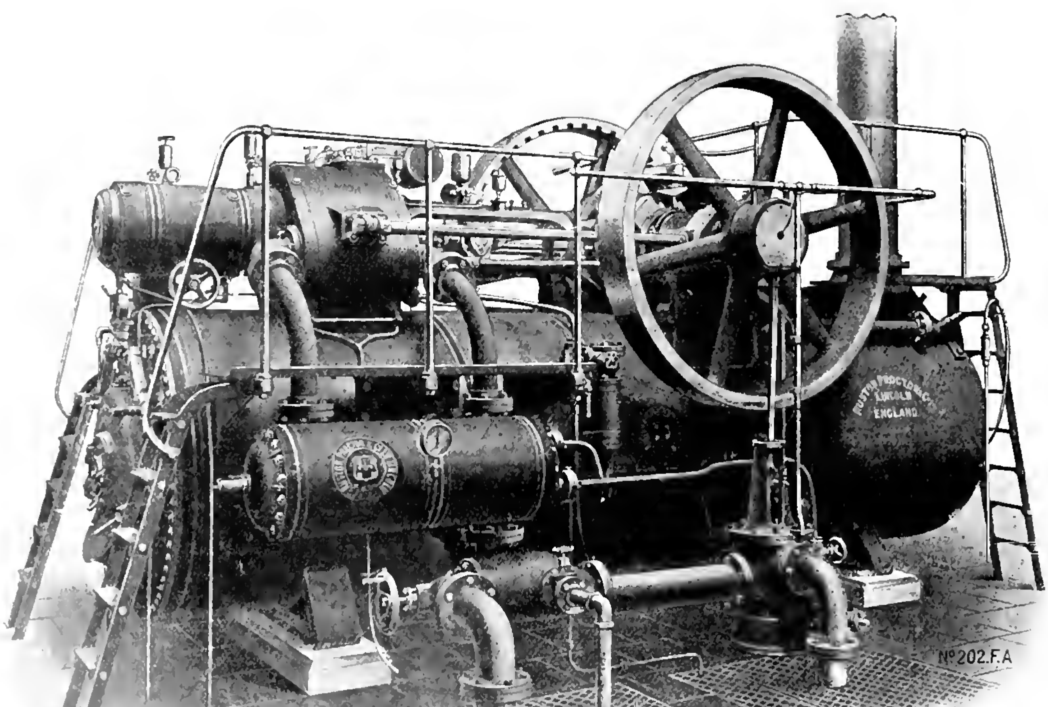
The first building to be traversed by the main route through the Exhibition is the Industrial Hall of Belgium, and next, that of Great Britain; passing on, the French industries can be seen, and then, from a gallery, the Machinery Hall, in which are housed the large exhibits of Britain, Belgium, France and Holland, can be surveyed. Germany has a separate block of buildings entirely to herself, and while in these a few of the arts and sciences are shown, the main display is of engines and machine tools. The Industrial Hall of Britain contains few engineering features, except models of warships and liners, but mention must be made of a very fine display of instruments chiefly for electrical purposes. A collection of models loaned by the Home Office is very interesting as illustrating the new regulations for the care of people in workshops, coaling and unloading ships, etc. The French Industrial Hall is largely made up of exhibits by the various French iron and steel masters, and of its kind it is probably the best in the Exhibition. Many of the manufacturers have joined together in order to make one large, impressive stand; there are castings in all metals, large and small forgings for marine and all classes of work; some firms also have a wonderful display of drop forgings. The possibilities of welding by the use of water gas is well brought out by the exhibit of the Société Anonyme d'Escaust et Meuse, who exhibit steam and air receivers, pipes, etc., welded up by this gas.

The exhibits, both in the International Machinery Hall and in the German section, may be summed up under the head of steam turbines driving electrical machinery, air compressors, refrigerating machines, steam engines for electrical purposes, winding engines, tractors and engines of the portable and semi-portable type for general purposes, a very comprehensive display of machine tools, a few boilers and steam-raising accessories, harbour and ship auxiliary machinery, a very large number of models of dredgers, coal barges, cranes, pile drivers, lighthouses, harbours, etc., and internal combustion engines, including oil engines for marine purposes. It will be recognised from this summary how small a part marine engineering plays in the Exhibition, but when carefully examined this will occasion but little surprise if it be remembered that Holland and Belgium have a vast system of canals, and naturally, in both countries, there exists a large number of firms to supply the needs of this system of transport. For this reason it is probably the engineer who is particularly interested in harbour work, canalage, etc., who will find this Exhibition of the greatest value to him. Exhibits of this class are, for a large part, in the form of models. Messrs. A. F. Smülders of Schiedam show dredgers both of the bucket and suction type, coal barges, floating cranes and also a large bucket excavator in the grounds of the Exhibition. A somewhat similar stand containing models of dredgers of all types represents the firm of Conrad, of Haarlem. Probably the best dredger model is on the stand of Messrs. Der Kronigl. Machinen-Bauinspektor, of Stetten Bredon; a section is taken right through the hull, exposing the boilers and the main and auxiliary machinery; everything is beautifully finished right down to the smallest detail; the scale of the model is 1/25th of the actual size.

In traversing the German section, in which the models may be numbered by the scores, one can see many of the best known lighthouses, panoramas of famous harbours and shipbuilding yards, ice breakers and models to illustrate their method of action. Many firms exhibit models of locks and lock gates suitable for docks and canals; the method of taking a canal over a hill is also beautifully illustrated. For the shipbuilder, many types of dry docks are exhibited, while a floating dock is shown by Messrs. Blohm & Voss, of Hamburg, the one represented being capable of raising 35,000



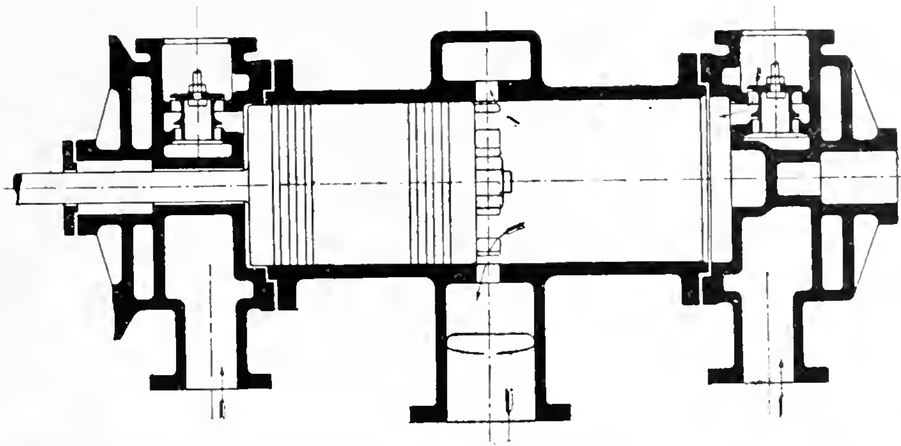
Single-Ended Air Compressor, driven by Electric Motor through Gearing, by Messrs. Reavell & Co., Ltd., Ipswich.



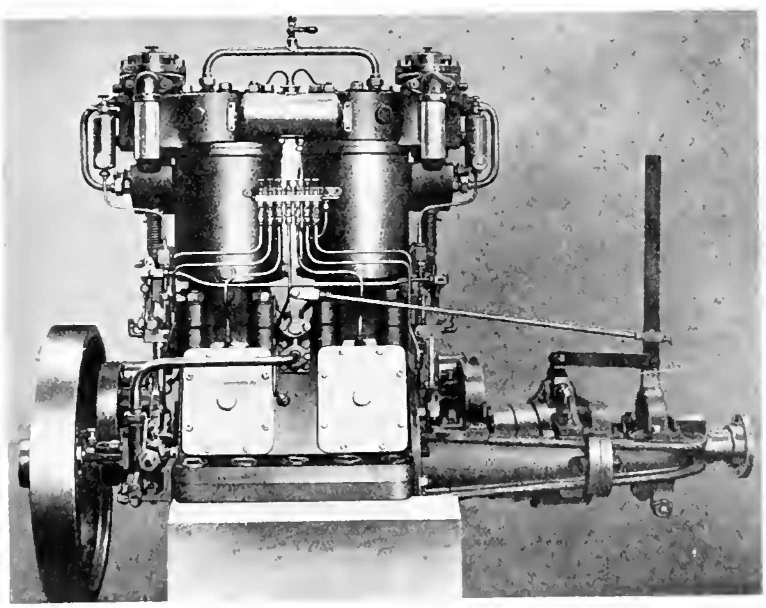
Superheated Steam Semi-Portable Engine by Messrs Ruston, Proctor & Co., Ltd

tons, and a section through the casing exposes much of the machinery, including the electrical plant, cranes and capstans. Messrs Ludwig, Stuckenholz and the Benrather Engineering Co., of Wetter and Benrather respectively, have combined together to give a most comprehensive display of cranes for almost all shipyard and harbour purposes, and models of building slips complete with the most approved equipment of cranes are shown ; in addition, they also exhibit metallurgical works appliances, as blast furnaces, rolling mills, etc.

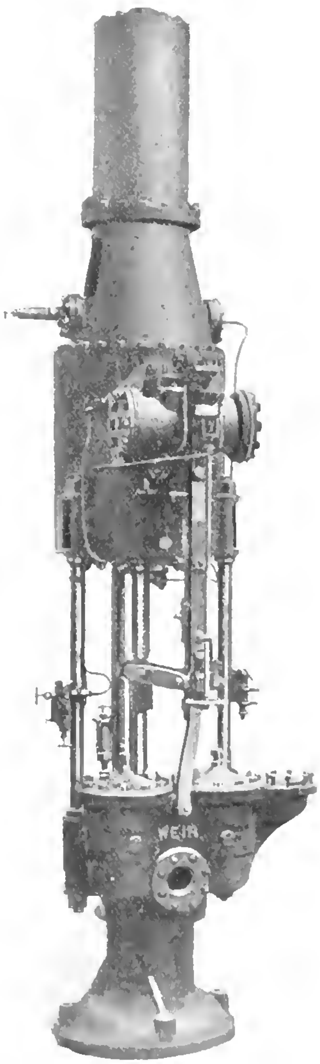
Pile-driving machinery is shown in the International Hall by the Haarlemsche Machinefabriek, of Haarlem ; the favourite apparatus in Holland, as in this country, is to draw the



The "Stumph" Engine.



The "Kromhout" Engine



Feed Pump
by Messrs G & J Weir.

"monkey" up by a winch and let it fall at the desired time. Complete machines for this purpose are exhibited, and in addition an interesting steam pile driver. It is customary, in this country, to use the steam pressure on the pile, but in this case, the steam is only used to raise the "monkey." The makers claim that by this the steam supply pipe is fixed and does not have to follow the "monkey," and that a more simple and accessible apparatus is obtained than with the other arrangement. A complete line of barge winches are also shown, and an electric lighting set for ship work. To those who wish to study the anatomy of a modern passenger steamer there is a most detailed sectional drawing and a model of the *George Washington.* A model of the machinery of the *Prinz Fredrich* shows every part of the engines, stern tubes, thrust blocks, propeller, etc. Many of the latest German warships and passenger steamers are also to be seen. The Vulcan Company have an interesting series of show cases, in which are shown models of the various warships they have built each year since the firm commenced

The British section contains models sent by Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., Messrs. R. & W. Hawthorn, Leslie & Co., Ltd., and the principal railways and shipping companies. Among the ships represented are the *Lusitania* and *Mauretania*, which excite much interest among visitors at the Exhibition.

Many Continental firms are displaying oil engines for marine purposes, none of them are by any means of the light motor boat type, but are of good solid construction and are especially suited for heavy barge work, and, in some cases, for sea-going vessels. Messrs. Drakenburgh, of Utrecht, have an extensive stand, and their method of adjusting the gudgeon pin is interesting. Half-way down the connecting rod two yokes are forged out and the top end bolts are extended to this, hence they can very easily be tightened up.

The "Kromhout" engine, made by Messrs. D. Goedkoop, jnr., of Amsterdam, and vended in this country by Messrs. Perman & Co., Ltd., of Great Tower Street, London, is exhibited in several sizes, and a description of this engine may be of interest. The exhibit includes 20, 40 and 70 h.p. two-cylinder engines, and 14 and 28 h.p. engines with one

cylinder. A general view of those of the first type is shown herewith. The cylinders are vertical, single acting and work on the "Otto" cycle. The makers, bearing in mind that this is a commercial machine, have designed all parts to be simple and as automatic as possible; for instance, all crankshaft bearings are ring oiled and the important adjuncts, vaporiser and igniter are exceedingly simple. The engine is constructed to work on common paraffin, and later improvements have made it possible to run on gas oil. The fuel supply is by a small plunger pump on each cylinder, the plunger being worked from an eccentric on the half-time shaft—the throw of the pump can be regulated at will. The inlet valve is atmospherically operated and is contained in a removable cage; the oil is sprayed over this valve and the in-coming air becomes thoroughly impermeated, and when impinging on the simple steel vaporizer, situated in the explosion chamber directly under the inlet valve, it becomes immediately vaporized. Ignition is by a low-tension magneto of the oscillating type, and is worked by a cam on the half-time shaft. The igniter in the cylinder head is magnetically operated. Governing is by means of a "Pendulum" governor acting on the exhaust valve which is worked by the same eccentric as the oil pump; when the speed is too high the exhaust valve is held open during the suction stroke, or, in other words, governing is by "hit and miss." The fuel, as already mentioned, may be either paraffin or "gas oil," but with the latter, as the explosions are intermittent and consequently the heat generated is less when governing that at full power, it is still necessary to run on ordinary paraffin until on full load. It is, however, possible to run the engine at any load on a mixture of one-third paraffin and two-thirds gas oil. The consumption of paraffin is about ·72 pint per B.H.P. per hour. The starting system is very simple; a petrol container is fitted near the delivery pipe of the feed pump. Then the engine is turned until the piston is about to commence suction. The feed pump is then worked by hand, forcing paraffin into the bottom of the container and expelling the petrol in a spray over the inlet valve. The fly-wheel is then given a quarter of a turn on the suction stroke, the charge is sucked in, and on turning the fly-wheel backwards, the charge is compressed and exploded by the magneto. The engine is fitted with reverse gear enabling it to drive a solid propeller. In conclusion, it may be said that this engine thoroughly represents the best Continental construction, and it is with pleasure we note that Messrs. Plenty & Son, of Newbury, have undertaken its manufacture in this country.

There are no marine steam turbines exhibited, although there are many turbines running, and in most cases driving electric machines to supply power to the Exhibition. Messrs. C. A. Parsons do not show a turbine, but Messrs. John Cockerill and Brown-Boverie show Parsons type machines. The "Zoelly" turbine is exhibited by Messrs. Gebr. Stork; the "Bergmann" by the makers of that name; there are various other turbines exhibited, but all are of the high-speed "impulse" type, suitable only for electric driving. To the central station engineer these electrical installations are very interesting, since, in many cases, the turbine is complete with all foundations and condensing plants. The aggregate horse power of the various turbines at work is several thousand, when run at full load. The marine steam engine is only a little better represented than the marine turbine; a Dutch firm shows a small compound engine complete with condenser, and crosshead worked air, circulating and feed pumps. Messrs. Lanz, of Mannheim, have a 6000 h.p. four-cylinder torpedo boat engine. In construction it follows the general lines for this class of machinery, but it is made very interesting by the makers' special type of valve gear with which it is fitted. There are four double-seated poppet valves, two at either end of the cylinder, one for inlet and the other for exhaust. A long shaft runs by the side of the cylinders, the whole length of the engine, and is rotated by eccentrics at one end. Suitable cams are fitted to this shaft and they open and close the valves against springs. The valve gear, worked by only two eccentrics, has far less complication than any other marine engine, and is the simplest possible drop valve arrangement. As it is well known drop valves give better running than those of any other type, especially with superheated steam which is much used for marine purposes on the Continent.

Messrs. Lanz, Wolf, Ruston Proctor and Garrett show fine examples of locomobiles, *i.e.*, a kind of semi-portable engine in which the cylinders are placed on top of the boilers. The steam is superheated, and the absence of long connecting pipes between engine and boiler causes the steam consumption to be very low—the coal used, even on plants of about 50 h.p., is only about 1·2 lbs. per h.p. per hour. Messrs. Lanz exhibit a locomobile of 1000 h.p. direct coupled to a dynamo—this is the largest locomobile ever made. There are many instances of shipyards, works and central stations in which these engines are running with great economy; the small floor space which they take up reduces the initial cost of building to a minimum. There are very few vertical steam engines in the Exhibition, with the exception of a number of small ship lighting sets. In addition to the 6000 h.p. torpedo boat engine mentioned above, there is a high-speed enclosed engine by the Machine Boulte Larbodiere, of Paris. Stationary horizontal engines are shown by many makers; of the English, Messrs. Marshall & Sons and Messrs. Ruston & Proctor show the largest, the last firm having a 350/500 h.p. tandem compound condensing engine. The majority of the Continental makers' engines are at work, they include a tandem compound Corliss engine belt driving a dynamo, on the stand of Van Coppenole, of Belgium; a two-crank simple winding engine fitted with a Proell valve gear by the firm of Thirian, of La Croyere; a 520 KW. compound tandem set by Van der Kerchove, of Ghent, and fitted with the makers' special piston valve gear; the Soc. de la Meuse, of Liege, show several large engines; the Soc. Ateliers Zimmermann—Hanrez have a 400 KW tandem compound generating set, and also exhibit a locomotive in the Railway Hall.

Messrs. Gebr. Stork & Co., of Hengelo, are showing a new type of engine constructed under the patent of Professor Stumph. From the section shown on page 457 it will be seen that there are only inlet valves, exhaust being taken from ports in the middle of the cylinder, the piston opening and closing them. The great advantage claimed is that the steam always travels in one direction and therefore the inlet passages and clearances are not cooled by exhaust steam, thereby avoiding much initial condensation. When the piston returns the steam is compressed up to its initial temperature and pressure. It is claimed that on this system steam can be completely expanded in one cylinder and that the complications of compounding are avoided, and further there are no exhaust valves. Many engines on this system have been built on the Continent, and have shown great economy; in this country the Marine Works of Friar House, New Broad Street, are the representatives.

The Exhibition includes a very fine display of gas and oil engines and producer plants, the majority of which, and certainly the best, are sent by Britain. The makers include Messrs. Crossley Bros., Ltd., Messrs. Campbell & Co., Ltd., The National Gas Engine Co., Ltd., Messrs. Marshall and Sons, Ltd., Messrs. Blackstone & Co., Ltd., who show, in addition to other engines, a 60-h.p. four-cylinder vertical marine engine to run on crude oil; Messrs. Ruston & Proctor, Ltd., and Messrs. J. B. Petter & Son, Ltd. The firm of Schmidt, of Cologne, show good examples of modern gas engines and producers. Air-compressing machinery is extensively represented, the well-known compressors of Reavell and Lacy-Hulbert are to be seen, and among the Continental firms, A. Borsig, of Tegel, have several large machines; Pokeney & Wittekind, of Frankfurt, exhibit a turbine compressor and a two-stage machine on the "Köster" system. Great attention has been given to ice-making and refrigerating plants, and there must be quite ten firms exhibiting this class of machinery.

While at the Exhibition the writer failed to see any marine boilers, although there were a few of the water-tube, Cornish and Lancashire type. In the German section there was a model of a Schmidt superheater, and the Deutsche Economiser Werke show a complete power house boiler room model, including the economisers, boilers feed pumps, etc.

The Underfeed Stoker Co., Ltd., of London, have one of their special stokers on their stand, while ten others are fitted to the boilers which supply steam to the Exhibition. The system of feeding the coal is to pass it up, by a special conveyor or ram, through the centre of the furnace—the makers claim by this method that the combustion is far

more perfect than is obtained by the usual way of feeding on the top of the fire.

Boiler feeding apparatus is shown by Messrs. G. A. J. Weir and Co., Ltd., the exhibit includes a number of their well-known pumps for land and marine purposes. Steam fittings of all kinds are shown at the stand of Messrs. J. Hopinson and Co., Ltd., and a large number of injectors of different types are exhibited by Messrs. Holden & Brooke, Ltd.: Julius Blancke have a large stand devoted to steam fittings, valves, lubricators, governors, etc. Large machine forgings are to be seen on many of the stands in the French section, but the best are in the German building; the exhibit of Messrs. Henschel & Sohn, of Hattingen-Ruhr, is particularly striking; it includes a tail shaft about 80 ft. long, large crank shafts, connecting rods, locomotive forgings, rolls, all arranged in one central stand forming a very imposing group. The Union Dortmund have a number of large anchors, and C. Heckmann, of Duisburg, have a stand which immediately attracts attention; it is made up of copper and bronze pipes, castings and pressed pieces, all beautifully finished and polished.

Machine tools of all kinds are largely represented in the German section, nearly all are working, but unfortunately they are very crowded together; few are of large size and there is little strikingly new. Among the firms exhibiting may be mentioned Messrs. Henry Pels & Co., who have a number of their well-known punching, shearing and cropping machines; Messrs. L. Schuler & Co., with metal-working tools; Messrs. Reinecker & Co., and Messrs. Mayer and Schmidt with their celebrated specialities. Messrs. Pilleter & Klunz with planers and power hammers. In the International Hall, the Soc. de Constructions Mécaniques de Longoz have many fine lathes and boring mills; the majority of the American makers are represented on the stands of Messrs. Alfred Schutte, Messrs. Pratt & Whitney, and Messrs. Brown and Sharpe. The firm of Bliss have metal-working tools, and Panhard & Levassoir wood-working machinery. British exhibitors include Messrs. William Asquith, Ltd., Messrs. J. Butler, Ltd., Messrs. Jonas & Colver, Ltd., Messrs. Kendall and Ghent, Ltd., Messrs. William Muir, Ltd., Messrs. J. Rhodes & Son, Ltd., Messrs. Thomas Robinson & Son, Ltd., and Messrs. Smith & Coventry, Ltd. Steam and pneumatic hammers are shown by Messrs. B. & S. Massey & Co., Ltd., and Messrs. Billeter & Klunz. In the Railway Halls there is a very fine collection of large locomotives and rolling stock by Belgian, German and Austrian firms.

The exhibit of the well-known "Renold" driving chains is of interest in the Engineering Section, an illustrated eight-page pamphlet in English, French and German dealing with a few interesting applications of chain drive, for example—line and countershaft, machine tool feed, steam engine governor, is available at the stand.

From an electrician's point of view the Exhibition is most disappointing; except for machines which are running there are only two or three firms which make a show of dynamos, and there are no electrical details to be seen. The Lahmeyer Company have a large stand on which there are many turbine-driven machines.

In this summary of the Exhibition it has been impossible to either describe all the exhibits or to name many of the exhibitors—the most important and most interesting have been singled out, and especial reference has been made to those exhibits which are of most interest to the marine engineer.

EXTENSION OF A REPAIRING ESTABLISHMENT IN ANTWERP.—We hear that the well-known firm of engineers and general ship repairers, Messrs. Béhard, Crighton & Co., of Antwerp, have taken over the Atlas Marine Engineering Co., Ltd., in order to enlarge their present works, which covered already some 48,000 square feet, fitted up with the most modern machinery. No doubt this will mark a new era of progress for this successful firm.

STEAMSHIPS AND THEIR STORY.—Messrs. Sidgwick and Jackson announce for early publication the companion volume to their "Sailing Ships and their Story" which was received with such success last year. This is "Steamships and their Story," by Mr. R. A. Fletcher, the well-known expert in his subject, who has spent many years collecting material for his book. The illustrations will be on an even more lavish scale than in the previous volume.

REPAIRS TO TAIL-END SHAFT OF SS. "ANGLIAN."

THE Leyland Line ss. *Anglian*, while on a voyage from Boston to London, fractured her "tail-end" shaft during a heavy gale on April 8th, 1910. The damage consisted of a circumferential fracture about one inch forward of the stern gland, at the forward end of the continuous liner, running off longitudinally forward about 7 inches and aft to about the same extent inside the liner, though this latter could not be ascertained at the time; the stern gland was also broken. To get abaft the circumferential fracture as far as possible so as to make effective repairs, it was necessary to draw the stern gland, take out the packing, and then screw the gland up as far as possible. The liner being bulged forward of the gland, about one inch had to be cut off before the gland could be drawn. After the latter was drawn the packing was taken out and the gland screwed up another 1½ inches; a further portion of the liner was then cut off, exposing the shaft 2½ inches abaft the circumferential fracture. A steel key 2 in. × 3½ in. × 6 in. was then fitted in the shaft in the only good part available for this purpose, and a pair of "bottom end" brasses bolted over all by two 4-in. main bearing bolts; the "bottom end" bolts being too long for clearance, the difference between the sizes of bolts and holes—4 in. and 4½ in.—was made up by bushes of ¼-inch Muntz metal and the bolts thus made a driving fit. On these repairs the *Anglian* steamed 540 miles at an average speed of seven knots, arriving at Queenstown and anchoring in the harbour there without assistance, the repairs still holding good.

The *Anglian* left Queenstown for London with two tugs in attendance at 4 p.m., April 19th, steaming at a speed of 7½ knots. All went well until 10 a.m. on the 20th, when, in response to an urgent order from the bridge, accompanied by a verbal message from the Master, which under the circumstances it was impossible to disregard, the engines were reversed, with the result that the shaft parted and slipped aft, the broken ends fouling, bending intermediate shaft, and breaking two tunnel-bearing pedestals. The remainder of the voyage to London was performed in tow of the two tugs attending, but had it not been for the order to go "Full speed astern," there is not the slightest doubt the repaired shaft would have taken the ship to her destination, as up to the time of going astern, it remained in as good order as when the repair was completed, and up to the time of attempting to carry out the emergency order and go full speed astern, it had taken the ship 670 miles.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

Portsmouth Dockyard.

EXCELLENT progress is being made with the construction of the battleship *Orion*, and it is confidently anticipated that she will be ready to take the water in August. A sad accident recently occurred, a labourer who was working on the vessel having been crushed to death by an armour plate. The *Neptune*, too, will before very long be ready for her steam trials. The cruiser *Good Hope* is still in hand undergoing a refit. The cruiser *King Alfred*, the old flagship of Vice-Admiral Sir Hedworth Lambton which returned from China a short time ago, has gone to Devonport, where she has taken up duty as flagship of the division of the Home Fleet at that port. The sloop *Espiegle* has arrived here from the western port and is temporarily acting as tender to the *Mercury*, the depot ship of Section II. of submarines. Some interesting mining experiments have recently been carried out by the *Redwing*, one of the special service vessels attached to the torpedo school-ship *Vernon* with the object of ascertaining the effect of a strong current, in a narrow channel, on submarine mines. The experiments

* Contributed by Mr. E. W. Rutter, R.D., R.N.R., to the Institute of Marine Engineers. July issue of Transactions.

took place in the narrow passage between Hayling Island and Fort Cumberland, where there is always a strong current and deep water. It is understood that some important information was obtained. A remarkable find has been made in the Solent by some fishermen who, while trawling, hauled up a torpedo. The torpedo was taken to the *Vernon* and it was ascertained that it was lost from the *Glatton* about thirty years ago. Some parts of the casing had suffered from the effects of sea water, but the machinery was in good order, while in the air chamber there was about 30 lb. pressure of air to the square inch. The *Glatton*, it may be mentioned, was the first British warship to be fitted with special appliances for discharging torpedoes. The torpedo will no doubt be placed in a museum. The hulk *Marlborough*, which has for some time past been attached to the *Vernon*, is to be sold out of the Service. She was a first-class steam three-decker with 131 guns, and was built at this yard. When she goes the only wooden vessel left here will be the *Victory*. Another hulk which will shortly go to the shipbreaker is the *Nelson*, which until quite recently was a training ship for stokers. The battleship *Renown* now carries out that duty. The contingent of officers and men of the Australian Navy who have come to England to take out the two destroyers which are being built for the Commonwealth Government, have been attached to various harbour ships until their own vessels are ready for the purpose of going through instructional courses in gunnery, torpedo and signals and other subjects. We shall shortly be losing Commander H. Simms, who has been at this yard since the beginning of last year. He is going to Chatham for duty as assistant King's harbourmaster and as assistant to the captain of the dockyard.

Devonport Dockyard.

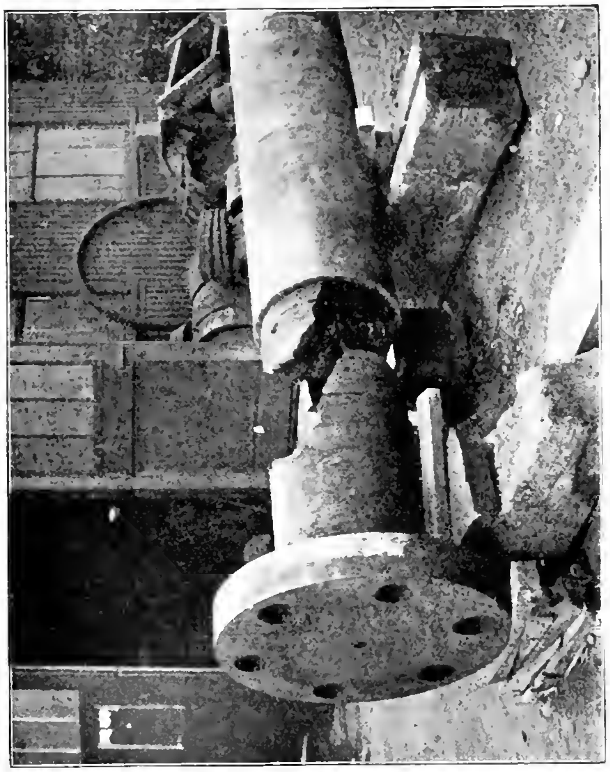
The construction of the armoured cruiser *Lion* is making more rapid progress than was anticipated, and the date of the launch has been fixed for August 6th. In anticipation of the launch good progress is being made with lengthening No. 8 Dock at the North Yard. In consequence of the enormous length of the *Lion* it has been found necessary to extend the dock ten feet along the centre line, while at the end there will be a triangular recess large enough to admit the stem of the vessel. No. 4 Dock in the South Yard is also being altered with the view to doubling its capacity for the docking of destroyers, while one of the old building slips at the Mutton Cove end of the yard is being converted into a shallow dock for torpedo craft. Excellent progress is being made with the armoured cruiser *Indefatigable* and there is every reason to believe that she will be ready for the pennant in February. One striking addition recently made is the 12-inch armament of the foremost centre line barbette. The guns each weigh over 60 tons, but as the vessel is berthed under the 160-ton crane they are handled quite easily. The fore conning tower is of 10-inch hardened steel and is of the doorless pattern. The three funnels are in position, the last to be placed being the foremost, which was lengthened ten feet in order that the smoke may pass clear of the navigating bridge. The main tripod mast will shortly be in position, while the work in the engine department is progressing very satisfactorily. The work of preparing the cruiser *Niobe* for her new duties as a sea-going training ship for the Canadian Navy is well in hand, and she is to leave for Canada at the end of July. Engineer-Lieutenant P. Howe is to be lent to the Canadian Government as consulting engineer on the headquarters staff at Ottawa in connection with the organization of the Dominion Navy. Lieutenant Howe, who joined the service in 1894, formerly served as one of the assistant managers in the Engineering Department at this yard, and since September last he had been assistant to the Director of Dockyards at the Admiralty. Satisfactory reports having been received from small craft as to the working of their wireless apparatus, it has been decided to similarly equip the torpedo gunboat *Sharpshooter*. Consequent upon the transfer of the mechanicians' establishment to Chatham the old cruiser *Wallaroo*, which has been attached to the *Indus*, has been sent round to the Nore, and the *Tenedos I.*, the depot for boy artificers, has been brought here from Chatham. The announcement that the established list is to be reopened has given great satisfaction. The list had been closed since 1906.

Chatham Dockyard.

The battleship *Dominion* has had her refit completed and has rejoined the Second Division of the Home Fleet. The scout *Sentinel* has also had her overhaul completed and has left to rejoin the Devonport Division of the Home Fleet. The *Inflexible*, of the First Cruiser Squadron, has been placed in dock for her annual refit, and the battleship *Irresistible* has been taken in hand. The cruiser *Boadicea* came in for her first refit since hoisting the pennant a year ago, but there was not a great deal to do to her, and the necessary work was completed by June 15th. The *Thames*, the sea-going depot of Section III. Submarine Flotilla, has also come in for a refit, but she will be out of hand in time for the manœuvres. Our fifth submarine, *C* 34, was launched on June 8th, the launching ceremony being performed by Miss Ommanney, the daughter of the admiral-superintendent. The launch was quite private, and a short religious ceremony was conducted by the Rev. R. Wilson, chaplain to the Royal Marines. The vessel was afterwards towed into dock to be completed for sea. She is 135 feet in length, 13 feet 6 in. in breadth, and has a displacement when submerged of 321 tons. Her machinery, which is being constructed here, will be of 600 horse-power, giving a surface speed of 15 knots. The old cruiser *Wallaroo* arrived from Devonport on June 15th in tow of the cruiser *Talbot*. The vessel has been sent here in consequence of the transfer of the mechanicians' establishment from Devonport, where she has served as a training ship in practical boiler work. Stoker petty officers who have been under training at Devonport for the rank of mechanician are in future to be trained at the Royal Naval Barracks, Chatham, the workshops on shore which have been attached to the boy artificers' training depot ship *Tenedos* being appropriated for their use. The portion of the mechanician course which has been carried out in the *Wallaroo* will be continued in that ship, which is to be moored in the Medway. The *Tenedos III.*, it may be remembered, was recently taken to Devonport, and the boy artificers who have been accommodated in the *Tenedos I.* are to be transferred to her. The latter vessel has been taken to the western port by the battleship *Agamemnon*. The third vessel of the group, the *Tenedos II.*, formerly the *Triumph*, is to be placed on the sale list. The announcement that the established list is to be reopened was most welcome, as it means that about seventy vacancies will be filled. Commander Rimington will on July 7th vacate the post of assistant King's harbourmaster, which he has held since November, 1904. His successor is Commander Simms, from Portsmouth.

Sheerness Dockyard.

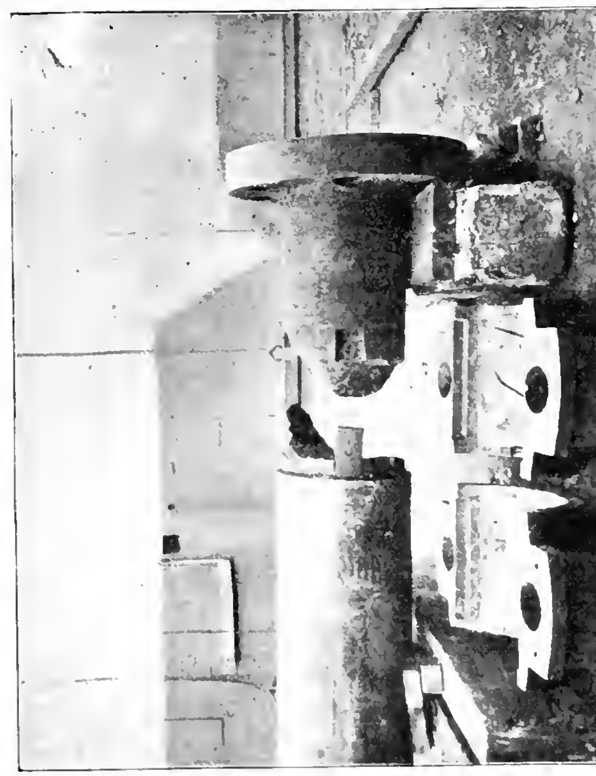
The *Amazon*, *Boyne*, *Wear*, *Teviot* and *Saracen*, of the First Destroyer Flotilla, have had their defects put right, but three of the flotilla are still in hand—the *Ness*, *Nith* and *Tartar*. They will, however, be finished in time to take part in the manœuvres. The *Saracen* had been here since last October, when she was damaged in collision in the North Sea. Shortly after having had the damage made good she ran ashore on the Shoeburyness Sands, and she has since undergone her annual survey and had various defects put right. With the exception of the *Swift*, all the ocean-going destroyers of the flotilla are attached to this yard for refitting, but as there is no dock long enough to accommodate that vessel, she will have to go to Chatham when repairs are needed. The *Swift* attracted much attention when she made her first appearance in the Medway at the end of May, being a vessel of quite a special type. Some years ago there were frequent appeals made to get No. 3 Dock extended so as to enable second-class cruisers to be docked here instead of sending them up to Chatham. Had the extension been carried out it would have been greatly to the advantage of Sheerness. The dock when it was constructed was long enough to accommodate the largest warships, but now it will not take a destroyer of the latest type. Submarine *C* 6 has completed her refit and has rejoined Section III of the flotilla at Harwich. The three vessels, *C* 1, *C* 3 and *C* 4, which are in hand, are to have their defects made good as expeditiously as possible. The torpedo gunboat *Harrier*, which was built at Devonport in 1895, has been taken in hand for a thorough overhaul and refit at a cost of over £18,000. Her refit is to be similar to that of the torpedo gunboat *Dryad*, which was in hand last year. The *Harrier* is attached to the *Dryad* at Portsmouth, both vessels being employed in connection with the training of officers in navigation. The visit of the vessels of the Third Destroyer Flotilla to Falmouth for firing exercises was attended by a



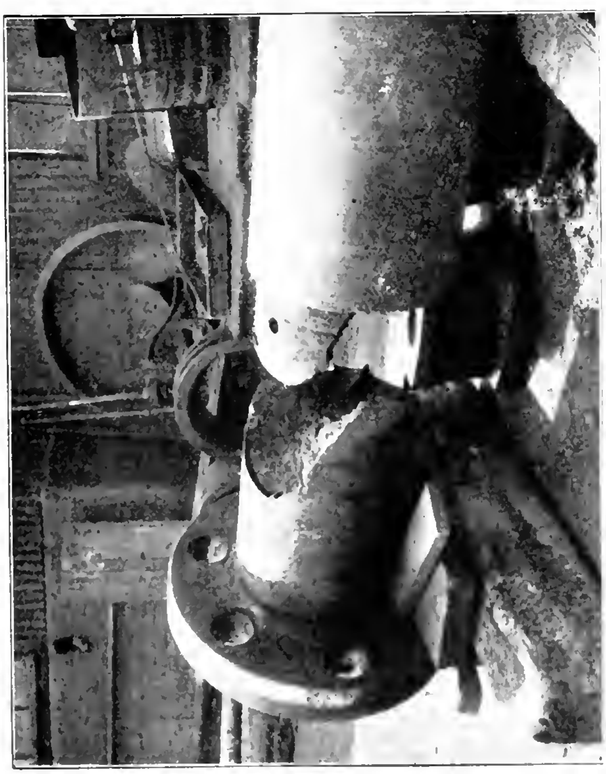
disaster, the *Quail* having run down a fishing boat during night operations. Four of the fishermen were drowned. A mishap occurred to the cruiser *St. George*, which went ashore on Folly Point during the afternoon of June 11th and remained until two o'clock next morning. The vessel was going to the moorings originally laid for the *Trafalgar*, and which are now usually occupied by the *Vengeance*. The spot was specially dredged for the *Trafalgar*, and as there was not enough swinging room the battleship was moored head and stern. The accident in no way indicates a difficulty in navigation between this port and Chatham, the moorings being out of the channel. On the King's birthday the gratifying announcement was made that the established list was to be reopened. The news of the somewhat sudden death of Rear-Admiral Casement, who was captain-superintendent here two years ago, was received with extreme regret, as he had been very popular.

Pembroke Dockyard.

The first of our new vessels to be laid down is to be named the *Barrosa* and the other, it is understood, will be called the



Illustrations relating to "Repairs to Tail end Shaft of S.S. *Anglian*" (page 459).



Barracouta. It is an interesting coincidence that the previous ships bearing these names were sisters of the old *Blanche* and *Blonde*, both of which were built here while the new vessels will be sisters of the *Blanche* and *Blonde*, now under construction at this yard. The launch of the latter vessel will take place during the first week in July. The contracting engineers, in order to get the boring operations for the propeller shafts completed are working day and night shifts and even on Sundays. At the time of writing it appears probable that it will take them almost to the day of the launch to complete boring and it is quite possible that they may not succeed in completing it by that time. With regard to the *Blanche*, six of the ten 4 inch quick firing guns with the mountings have been delivered and the other four are shortly expected. The manufacturers are Messrs. Vickers, Sons & Maxim, and the mountings are built on the Maxim principle. A most distinguished party arrived here at the end of May in the Admiralty yacht *Enchantress*, including Mr. McKenna the First Lord of the Admiralty an

his brother, Mrs. McKenna and her father, Sir Herbert Jekyll, the Prime Minister, Rear-Admiral Sir John Jellicoe, Controller of the Navy, and his secretary, Mr. Baddeley, and Captain Troubridge, the naval secretary to the First Lord. The private members of the party proceeded to Stackpole Court, the country seat of Earl Cawdor, while the officials inspected the yard. They first visited No. 5 slip, where the *Blonde* is under construction, the Carr Jetty, alongside which the *Blanche*, *Antelope* and *Sylvia* were lying, their Lordships going on board the *Blanche* and inspecting portions of her. They then went to the mould loft, and lastly to the Dockyard Chapel, the restoration of which, after damage by fire, has been recently completed. The destroyer *Sylvia* has completed her refit and having carried out a satisfactory commissioning trial has proceeded to Devonport to join the Fifth Destroyer Flotilla. The yard authorities are very pleased with the trials of the vessel and also as to the behaviour of her machinery on the passage round to Devonport, concerning which an excellent report has reached us. It is considered a matter for congratulation that an equally good result was obtained in the case of the *Osprey* and of the *Violet*, which previously underwent similar refits at this yard. The gunboat *Antelope* has also completed her refit, and has been commissioned with a crew from Portsmouth for service at that port with the submarine flotilla. Another destroyer, the *Foyle*, has arrived from Devonport for a refit. Two gangs of shipwrights, numbering about fifty men, have been transferred from the *Blonde* to No. 1 building slip to commence the construction of the first of the two battle-practice targets which are to be built here.

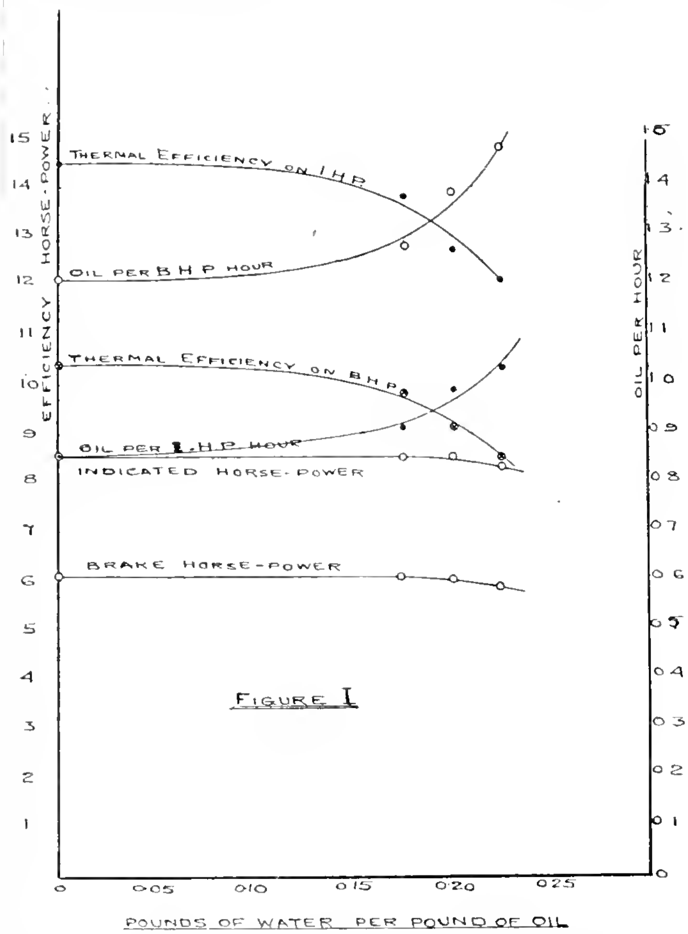
AN EXPERIMENTAL STUDY OF AN OIL ENGINE.*

THE oil engine upon which these tests were carried out has a single cylinder of 8½ in. bore and 14 in. stroke. There is one fly-wheel 5 ft. 2 in. diameter which is fitted with a rope brake to take up the power. The normal speed of the engine is 250 revolutions per minute, at which speed the governor comes into action, holding open the exhaust valve and preventing the suction of fresh mixture until the speed has fallen to its normal value. The supply of oil to the engine is from a graduated tank to an automatic mushroom type valve. The oil passes through fine holes in the seating of the valve, which simply serves for the admission of air. This valve is mounted at the top of a vapourizer kept hot by means of a paraffin blow-lamp; the lower end of the vapourizer contains the ignition tube. There is no timing valve and ignition takes place automatically at a point in the stroke which is governed entirely by the temperature of the ignition tube, the composition of the charge, and the compression in the cylinder. The exact nature of the contents of the cylinder is thus necessarily difficult to estimate and the problem is still further complicated by the difficulty of maintaining the firing point at any definite fixed period in the stroke for any length of time. Between the vapourizer and the cylinder itself there is a short circular cored passage passing through the water jacket, but not communicating in any way therewith. This passage is fitted with an automatic valve of special design which allows water to be drawn into the cylinder and mixed with the oil vapour on the suction stroke of the engine, the mixture of oil vapour and water vapour being compressed and fired on the return stroke of the engine. The purpose of the water injection is to tone down the violence of the explosion and prevent the harsh metallic knocking within the cylinder which is such an objectionable feature of most paraffin oil engines, and this it does most effectively. The water supply comes from a small tank especially graduated for the purpose.

Having proved that the injection of water with the oil vapour diminishes the violence of the explosion, the question arises as to what the effect is upon the economy of the engine working. To ascertain this the author had a series of tests made upon the engine, keeping the brake load constant and all other conditions as nearly as possible so, but varying the amount of water injected. The results of these tests, collected and worked out, are given in Table I. and Fig. 1. They show that the thermal efficiency and the economy of the engine quickly decrease as the amount of water injected increases, but the noise and violence of the explosions get less and less, so that quietness of running is secured at the expense of economy in running costs.

The chemical formula for water being H_2O and for a paraffin $C_nH_{2n+6}H_6$, some interesting speculation was indulged in as to whether any dissociation of the H_2O would occur inside the cylinder during combustion.

It seemed to the author that if an approximate simple analysis was made of the exhaust gases, and if they were found to contain a marked difference of nitrogen (or other unknown commodities such as hydrocarbons), when the water was injected, such evidence would prove whether or not dis-



sociation had taken place and whether it would be advisable to place the gas analysis in the hands of a qualified analyst.

He therefore began a series of experiments tentatively by himself and, encouraged by the results, proceeded with the full investigation. In running the engine tests the observations were made one minute after each other and timed by a stop-watch; there being five principal observations it took five minutes to start and stop a test, the intervening period allowing for gas sampling and indicating. Fig. 2, which is plotted from the observations given in Table II., shows the results obtained from a series of experiments which were made under constant conditions. The outlet temperature of the jacket water was kept at 100°F., the load on the brake at 50 lb. nett, the oil cock one-eighth turn open and the same tension on the mixture valve spring all through.

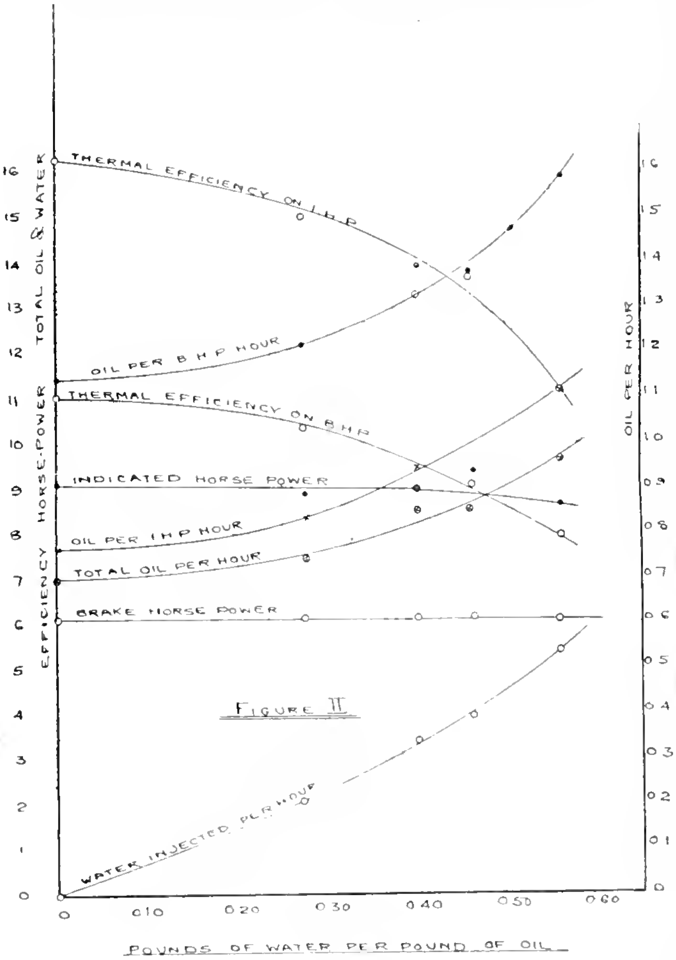
The blow-lamp was kept in a fixed position below the ignition tube and the flame maintained as nearly as possible at one definite intensity. The amount of water injection was varied

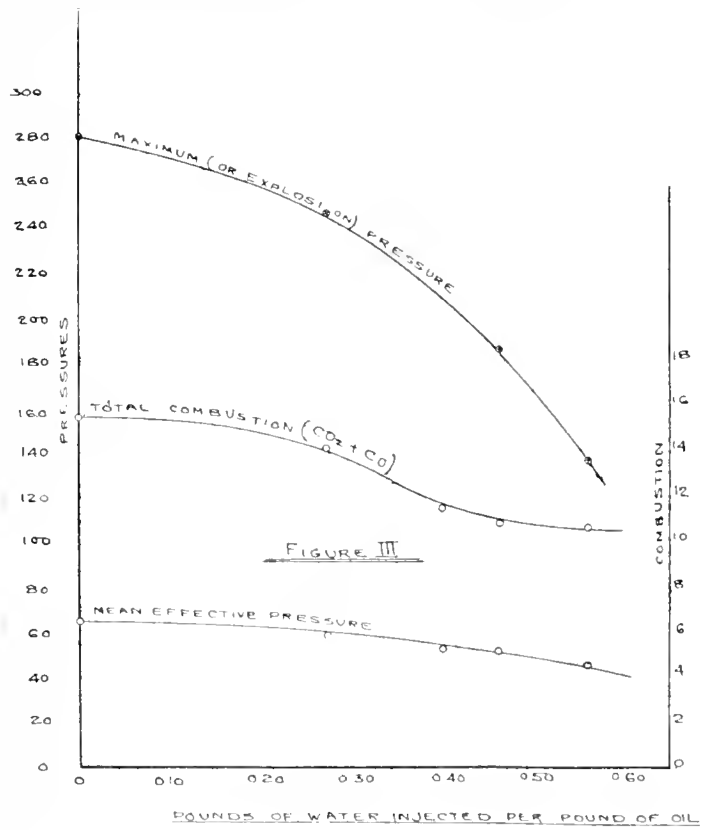
* Read by Mr. F. J. Kean, B.Sc. (Lond.), Member of the Institute of Marine Engineers, in the Hall of the Garden Club, at the Japan-British Exhibition on June 25th, 1910, the Hon. Wm. Hall Jones, High Commissioner for New Zealand, in the chair.

both by opening the water cock and by releasing the tension on the water valve spring. It will be observed that the results obtained are very similar to those shown in Fig. 1, except perhaps that the amount of water injection is much greater, reaching the extraordinary figure of 56 per cent. With this amount of water injection the running of the engine was very similar to that of a single-acting steam engine (except for the noise made by the governor gear and the automatic inlet valves, the springs of which are not enclosed). The thermal efficiency falls off and the oil consumption rapidly increases with the amount of water injected, showing what an expensive means this is of obtaining a quiet running engine. The knocking does not cease until 30 per cent. of water is being injected, though even when 56 per cent. of water was being injected the noise of the explosions within the cylinder could still be heard, but they sounded very faint and reminded one of listening to distant long range gun practice at sea.

water injection is merely to damp down the total combustion, causing the maximum or explosion pressure to occur later in the stroke and lowering its value.

The author thought that perhaps dissociation might take place if the explosions were made more violent and a higher maximum and mean temperature obtained in the cylinder. Accordingly the vapourizer and ignition tube were kept much hotter, the outlet temperature of the jacket water being kept the same (100° F.). It was thought advisable, however, to admit more air and put a little more load on the engine so as to improve the running conditions generally. A difficulty now presented itself on account of the vapourizer getting so hot that ignition occurred much too early and the engine slowed down. However with patience and after several attempts two satisfactory tests were made, the results being given in Table IV. The gas analysis shows slightly improved combustion when the water is being injected, but only the CO_2 is increased, the percentage of nitrogen being almost identical for both conditions, while the free O decreases. If the indicator diagrams be examined, it will be seen that the





The exhaust gases were sampled in the usual manner and analysed by the author with the Orsat apparatus. The results of the gas analysis are given in Table III, and plotted in Fig. 3, from which it will be seen how rapidly the total combustion (CO_2+CO from volumetric analysis) falls off, but it seems to reach a minimum value at about 50 per cent. of water injection, which is no doubt due to condensation of the oil and water vapour during compression the liquid leaking past the piston and leaving less combustible to be burnt with the same air supply. On the same diagram are shown also the explosion, or maximum pressure, occurring in the cylinder as measured from the indicator diagram and also the mean effective pressure. Examining the gas analysis figures we note that while the sum of CO_2 and CO by volume continually decreases, the free O continually increases, so that there is no evidence of any dissociation having taken place. Hence the author concludes that the effect of the effect of the water injection is to retard the firing point and bring it back nearly to the dead centre, the result being that a higher compression pressure is reached before ignition; this would, of course slightly increase the efficiency of the combustion process. The author does not at any rate, consider there is any evidence to show that dissociation has taken place. The last tests were made under similar conditions as regards the vapourizer but with the mixture valve adjusted as in the first tests, the load being 50 lb. nett but more water being injected. In this case the total combustion is distinctly decreased, and the test is a very remarkable one in many ways so that the author gives the working out in full below.

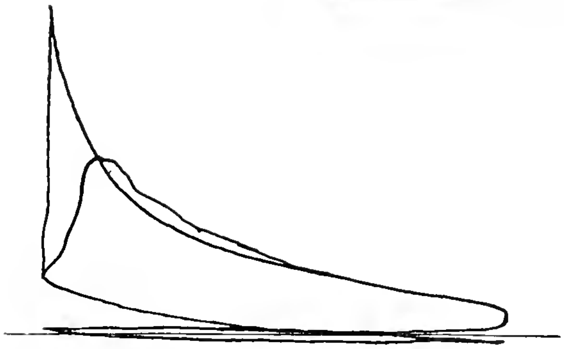
In test No. 12*a* ignition occurred when the compression pressure was as low as 25 lb. per sq. in. above atmosphere, whereas in test No. 12*b* ignition did not occur until the full compression pressure was reached, and under these conditions a very marked economy in the oil consumption was also noted on tests Nos. 10*b* and 11*b* under similar conditions. In 10*a*, 11*a* and 12*a*

it was noted that during certain periods of the test the engine laboured rather heavily and seemed inclined to slow down, whereas in 10*b*, 11*b* and 12*b*, no such result was observed. The author shows the oil consumption figures in Table V. for these tests ; but it must be remembered that in 10*a*, *b* and 11*a*, *b* the *air* supply was greater than in the earlier tests. In test No. 12*a*, *b* the *air* supply was the same as in tests 1 to 9

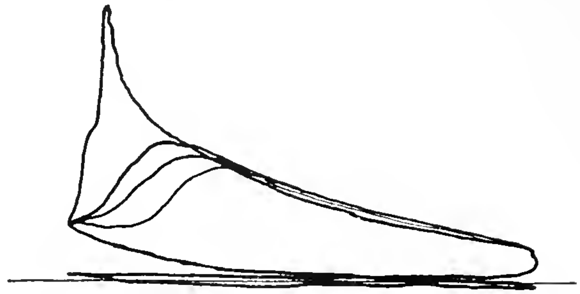
the economy—that is to say, the engine becomes less efficient.

4. That if in case (3) a greater economy results such economy is not due to dissociation of the H_2O, but is in reality due to improved conditions, (1) and (2), being realized as the result of injecting water with the charge.

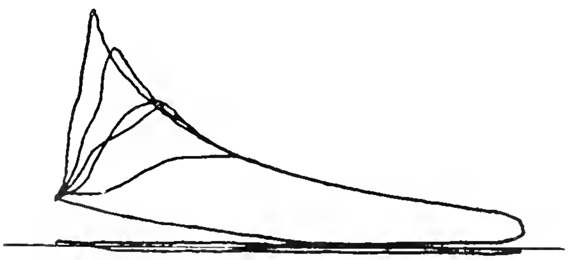
SCALE :- 1 INCH = 160 LBS/IN²



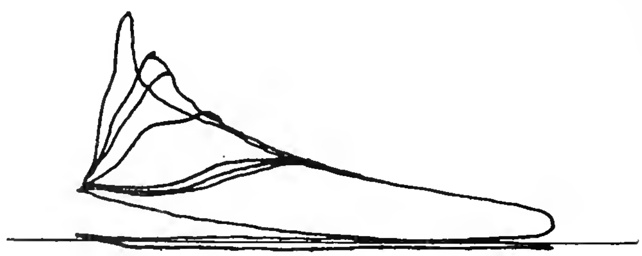
TEST No. 5



TEST No. 6



TEST No. 7



TEST No. 8

TEST No. 9

inclusive, so that 12*b* shows how by keeping the vapourizer much hotter the oil consumption may be greatly improved, the oil per horse-power hour in test No. 12*b* being much lower than that in test No. 5 for instance.

In summing up the author believes that he is justified in drawing the following conclusions from the results of his tests.

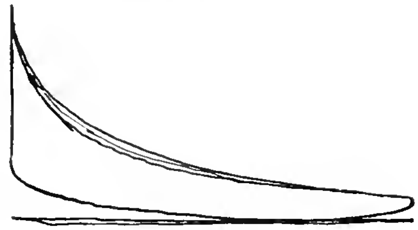
1. That in an oil engine the economy in oil consumption is greater with a moderately high compression than with a very low compression before ignition.
2. That the economy obtained by working with a very hot vapourizer is greater than that with one only moderately hot.
3. That the true effect of injecting water with the oil vapour is to damp down the total combustion and to lower

TABLE I.

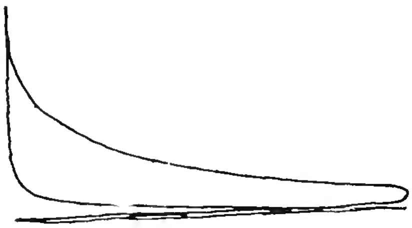
Test No.	Pounds of Water injected per pound of oil used.	Indicated Horse-Power.	Brake-Horse-Power.	Oil per I.H.P. per hour in pounds.	Oil per B.H.P. per hour in pounds.	Absolute Thermal Efficiency	
						on the I.H.P. (per cent.).	on the B.H.P. (per cent.).
1	0	8·55	6·10	0·86	1·21	14·5	10·4
2	0·174	8·50	6·04	0·91	1·28	13·8	9·8
3	0·198	8·50	6·05	0·99	1·39	12·7	9·1
4	0·232	8·30	5·81	1·03	1·48	12·1	8·5

Scale:- 1 inch = 200 lbs/in²

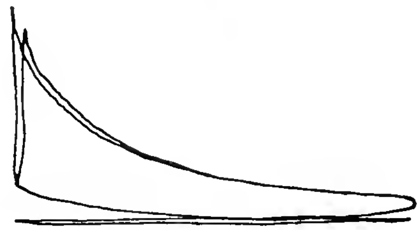
Test No. 10A.



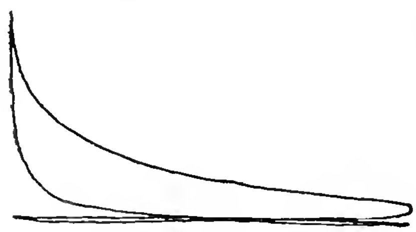
Test No. 10B



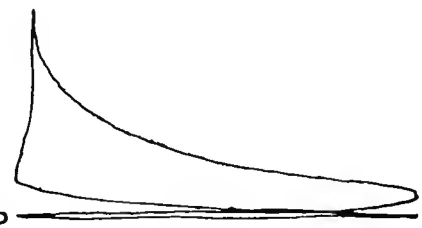
Test No. 11A



Test No. 11B

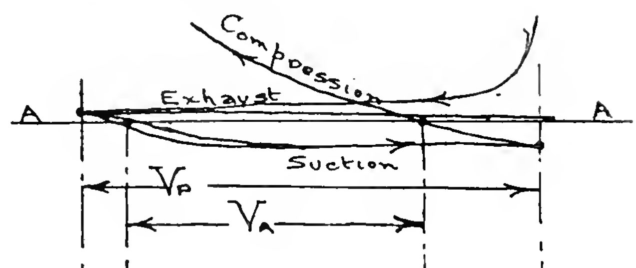


Test No. 12A

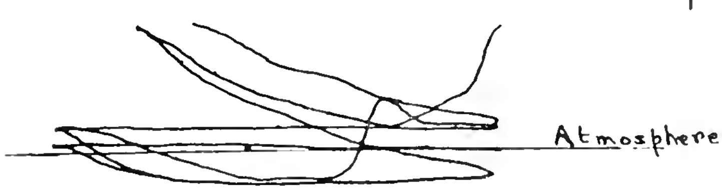


Test No. 12B.

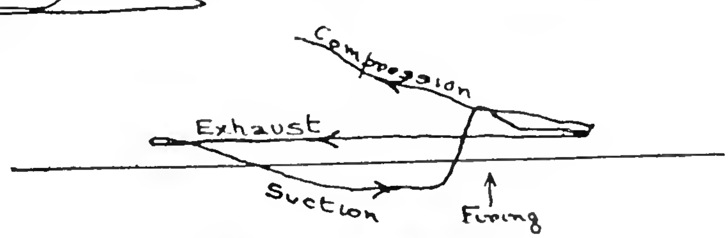
Test No: 12A



Test No. 12B



Test No. 13.



Backfiring

TABLE II.

Test No.	Pounds of Water injected per pound of oil used.	Indicated Horse-Power.	Brake-Horse-Power.	Oil per I.H.P. per hour in pounds.	Oil per B.H.P. per hour in pounds.	Absolute Thermal Efficiency. on the I.H.P. (per cent.).	Absolute Thermal Efficiency. on the B.H.P. (per cent.).
5	0	9·10	6·12	0·77	1·14	16·3	11·0
6	0·274	8·88	6·10	0·84	1·22	15·0	10·3
7	0·400	8·99	6·11	0·95	1·39	13·3	9·0
8	0·463	9·37	6·16	0·91	1·38	13·7	9·1
9	0·560	8·65	6·07	1·11	1·59	11·2	7·9

TABLE III.

Test No.	Pounds of Water Injected per pound of oil used.	Gas Analysis by Volume (per cent.). CO_2	CO	O	N, etc. (by difference).	ss Total Combustion $CO + CO_2$	Pressures from the Indicator Cards. Maximum or Explosion	Mean Effective.
5	0	9·4	6·2	0·4	84·0	15·6	280	63·1
6	0·244	9·6	4·5	0·6	85·3	14·1	245	58·6
7	0·400	6·9	4·6	6·9	81·6	11·5	190	52·9
8	0·463	6·7	4·1	6·0	83·2	10·8	185	51·3
9	0·560	6·7	3·9	6·4	83·0	10·6	136	45·3

TABLE IV.

Test No.	Pounds of Water injected per pound of oil used.	Gas Analysis by Volume (per cent.) CO_2	CO	O	N, etc. (by difference).	Total Combustion $CO_2 + CO$.	Pressures from the Indicator Cards. Maximum or Explosion.	Mean Effective.
10*a*	0	11·5	2·3	3·0	83·2	13·8	280	60
10*b*	0·271	12·1	2·0	2·0	83·9	14·1	280	59
11*a*	0	10·1	2·6	1·5	85·8	12·7	280	55·5
11*b*	0·284	11·4	1·5	1·6	85·5	12·9	280	62·8

TABLE V.

Test No.	Total Oil per hour. lbs.	Total Water per hour (injection).	Pounds of Water per lbs. of Oil.	I.H.P.	B.H.P.	Mechanical Efficiency. %	Oil per I.H.P. hour. Lbs.	Oil per B.H.P. hour. Lbs.
10*a*	7·31	0	0	12·00	7·57	63·1	0·609	0·966
10*b*	6·93	1·88	0·271	11·12	7·53	67·7	0·623	0·921
11*a*	6·55	0	0	9·84	6·54	66·5	0·666	1·000
11*b*	5·99	1·70	0·284	9·64	6·37	66·1	0·622	0·941
12*a*	8·31	0	0	11·02	6·31	57·3	0·754	1·317
12*b*	6·61	3·1	0·469	11·65	6·29	54·0	0·567	1·051

TESTS NOS. 12A AND 12B.

Test number	12*a*	12*b*
Conditions	Very early firing without water injection.	Very early firing with water injection.
Duration in minutes	30	30
Oil used per min. in the engine lb.	0·139	0·110
Water injection to the cylinder per min. .. .. .. lb.	nil	0·052
Pounds of water injected per pound of oil used in the engine	nil	0·469
Calorific value of the oil supply B.Th.U. per lb. (average value by calorimeter)	20,200	20,200
Average composition of the oil .. (Russian petroleum)	C. 86% H. 14%	C. 86% H. 14%
Speed in revolutions per min. ..	260·7	260·0
Explosions per min.	100·9	79·9
Explosion (or maximum) pressure lb. per sq. in.	275	275
Compression pressure (before firing) lb. per sq. in.	25	48
Suction pressure (from light spring diagram) .. .. lb. per sq. in.	4·0	4·0
Release pressure .. ,, ,,	30·0	26·0
Mean effective pressure ,, ,,	54·1	72·2
Indicated horse-power	11·02	11·65
Nett load on brake .. lb.	50·0	50·0
Brake horse-power	6·31	6·29
Mechanical efficiency per cent. ..	57·3	54·0
Jacket water in lb. per min. ..	19·3	15·0
Inlet temperature .. .. °F.	58·0	58·5
Outlet temperature .. .. ,,	100·0	102·0
Rise in temperature	42·0	43·5
Temperature of the air in engine-room °F.	63·0	65·0
Exhaust pipe temperature .. ,,	754·0	732·0
Exhaust gas analysis by volume per cent. .. .. .. °F.	CO_2 9·2 CO 5·5 O 1·4 N, etc. 83·9	CO_2 10·3 CO 2·3 O 3·7 N, etc. 83·7
Ratio of air to oil by weight—		
(1) From light spring diagram ..	21·6	20·8
(2) From gas analysis	14·66	17·22
Absolute thermal efficiency (on I.H.P.)	16·6%	22·2%
Absolute thermal efficiency (on B.H.P.)	9·5%	12·0%

HEAT ACCOUNT IN B.TH.U. PER MINUTE.
No. 12A.

Dr	B.Th.U.	%	Cr.	B.Th.U.	%
Heat supplied from the oil ..	2,808	100	Heat equivalent of I.H.P. ..	467·2	16·6
			Heat rejected in jacket water	810·8	28·9
			Heat lost by incomplete combustion (forming CO)	452·0	16·1
			Heat carried away by the products of combustion..	392·7	14·0
			Balance of heat account .. Radiation, errors of observation, etc. by difference	685·3	24·4
Total ..	2,808	100	Total ..	2,808·0	100·0

HEAT ACCOUNT IN B.TH.U. PER MINUTE.

Dr.	B Th. U.	%	Cr.	B Th. U.	%
Heat supplied from the oil ..	2,222	100	Heat equivalent of the I.H.P.	494·0	22·3
			Heat rejected in the jacket water ..	652·5	29·4
			Heat lost by incomplete combustion ..	174·5	7·8
			Heat carried away by the excess air ..	42·1	1·9
			Heat carried away by the products of combustion..	299·0	13·4
			Heat carried away by the steam from the water injection ..	70·9	3·2
			Balance of heat account .. Radiation, errors of observation, etc. by difference	489·0	22·0
Total ..	2,222	100	Total ..	2,222·0	100·0

CALCULATIONS FOR THE HEAT ACCOUNT.

NO. 12A.

Converting the volume analysis to a weight analysis—

	Volume fraction × Relative Density.	Fractional Weight.
CO_2	0·092 × 22 = 2·025	0·1371
CO	0·055 × 14 = 0·770	0·0521
O	0·014 × 16 = 0·224	0·0152
N, etc.	0·839 × 14 = 11·750	0·7956
Total	14·769	1·0000

Analysis of exhaust gases by weight—

CO_2 13·71% CO 5·21% O 1·52% N, etc., 79·56

Weight of carbon in 1 lb. of dry exhaust gas—

$= \frac{3}{11}$ of the CO_2 by weight $+ \frac{3}{7}$ of the CO by weight

$= \frac{3}{11} \times 0·1371 + \frac{3}{7} \times 0·052 = 0·0597.$

Weight of dry exhaust gas per 1 lb. of carbon burned—

$= \frac{1}{0·0597} = 16·75$ lb.

Weight of dry exhaust gas per 1 lb. of oil burned—

$= 16·75 \times$ (the weight of carbon in 1 lb. of oil)

$= 16·75 \times 0·86 = 14·4$ lb.

Weight of steam formed—

$= 9 \times$ (the weight of hydrogen in 1 lb. of oil).

$= 9 \times 0·14 = 1·26$ lb.

Total weight of exhaust gas per 1 lb. of oil burned = 15·66 lb.

Weight of air used per 1 lb. of oil = 15·66 — 1 = 14·66 lb.

Weight of air theoretically needed per 1 lb. of oil—

$= 11·56 \times$ (carbon in 1 lb. of oil) $+ 34·67 \times$ (hydrogen in 1 lb. of oil).

$= (11·56 \times 0·86) + (34·67 \times 0·14).$

$= 9·94 + 4·85 = 14·79$ lb.

Weight of products of combustion per 1 lb. of oil = 14·79 + 1 = 15·79 lb.

$$\frac{\text{Carbon burned to } CO_2}{\text{Whole carbon in 1 lb. of oil}} = \frac{CO_2 \text{ by volume}}{(CO_2 + CO) \text{ by volume}} = \frac{0·092}{0·147} = 0·626$$

∴ Carbon burned to $CO_2 = 0·626 \times 0·86 = 0·538$ lb. per 1 lb. of oil.

Carbon burned to CO = 0·86 — 0·538 = 0·322 lb. per 1 lb. of oil.

PRODUCTS OF COMBUSTION :—

			Per 1 lb. of products × specific heat.
CO_2	$= \frac{11}{3} \times 0·538 =$	1·973	0·127 × 0·216 = 0·0274
CO	$= \frac{7}{3} \times 0·322 =$	0·752	0·048 × 0·248 = 0·0119
O	$= 9 \times 0·14 =$	1·260	0·081 × 0·480 = 0·0389
N by difference		= 11·585	0·744 × 0·244 = 0·1816
Total		15·570	1·000 Total 0·2598

Mean specific heat per 1 lb. of products = 0·260.

NO. 12B.

Converting volume analysis to a weight analysis—

	Volume fraction × Relative Density	Fractional Weight
CO_2	0·103 × 22 = 2·266	0·1521
CO	0·023 × 14 = 0·322	0·0216
O	0·037 × 16 = 0·592	0·0397
N, etc.	0·837 × 14 = 11·732	0·7866
Total	14·903	1·0000

Analysis of exhaust gases by weight—

CO_2 15·21% CO 2·16% O 3·97% N, etc. 78·66%

Weight of carbon in 1 lb. of dry exhaust gas—

$= \frac{3}{11} \times 0·1521 + \frac{3}{7} \times 0·0216 = 0·0507$ lb.

∴ Weight of dry exhaust gas per 1 lb. of carbon burned.

$= \frac{1}{0·0507} = 19·72$ lb.

Weight of dry exhaust gas per 1 lb. of oil burned.—

$= 19·72 \times 0·86 = 16·96$ lb.

Weight of steam formed $= 9 \times 0·14 = 1·26$ lb.

Total weight of exhaust gas per 1 lb. of oil burned—

$= 16·96 + 1·26 = 18·22$ lb.

Weight of air used per 1 lb. of oil = 18·22 — 1 = 17·22 lb.

Weight of air theoretically needed per 1 lb. of oil = 14·79 lb.

Excess air per 1 lb. of oil = 17·22 — 14·79 = 2·43 lb.

Weight of products of combustion per 1 lb. of oil—

$= 14·79 + 1 = 15·79$ lb.

$$\frac{\text{Carbon burned to } CO_2}{\text{Whole carbon in the fuel}} = \frac{10·3}{10·3 + 2·3} = \frac{10·3}{12·6} = 0·818$$

∴ Carbon burned to $CO_2 = 0·818 \times 0·86 = 0·704$ lb. per 1 lb. of oil.

Carbon burned to CO = 0·86 — 0·704 = 0·157 lb. per 1 lb. of oil.

PRODUCTS OF COMBUSTION—

			Per 1 lb. of products × specific heat.
CO_2	$\frac{11}{3} \times 0·703 =$	2·577	0·163 × 0·216 = 0·0352
CO	$\frac{7}{3} \times 0·157 =$	0·366	0·023 × 0·248 = 0·0057
H_2O	$9 \times 0·14 =$	1·260	0·080 × 0·480 = 0·0384
N by difference		11·587	0·734 × 0·244 = 0·1791
Total		15·790	1·000 0·2584

Mean specific heat of products of combustion = 0·258.

NO. 12A AND 12B.

Heat lost by incomplete combustion =

{(Weight of carbon burned to CO per 1 lb. of oil) × (the difference between the calorific value of carbon burned to CO_2 and carbon burned to CO) × (the number of pounds of oil used per minute).

Heat carried away by the products of combustion—

= {(Weight of products per 1 lb. of oil) × (mean specific heat of products) × (the difference between the exhaust pipe temperature and the atmospheric temperature) × (the number of pounds of oil used per minute).

Heat carried away by the excess air =

= {(Weight of excess air per 1 lb. of oil) × (specific heat of air at constant pressure) × (the difference between the exhaust pipe temperature and the atmospheric temperature) × (the number of pounds of oil used per minute).

Heat carried away by the steam from the water injection =

= {(Number of pounds of water injected per minute) [(0·48 times the difference between the exhaust pipe temperature and 212° F.) + (the latent heat of steam at 212° F.) + (the difference between 212° F. and the air temperature.)]}

THE LIGHT SPRING DIAGRAMS.

Let Va = volume of charge drawn in at atmospheric pressure.

Vp = volume swept by piston.

Measure the lengths of Va and Vp on the diagram, then

$$\text{Actual volume of charge drawn in} = \frac{\text{length } Va}{\text{length } Vp} \times Vp \text{ in c. ft.}$$

(at atmospheric pressure Pa).

Assume the temperature of the charge (Ta ° F. absolute) to be the same as that of the jacket water at outlet. Calculate the density of air (ρ) at Ta ° F. absolute from the formulæ.

(1) $Pa\ Vta = 53{\cdot}8\ Ta$ per 1 lb. of dry air.

(2) $= \rho\ \frac{1}{Vta}$ lb. per cubic foot.

Total volume of air drawn in per minute $= Va \times$ (number of explosions per minute).

Weight of air drawn in per minute $= \rho Va\ n$.

$$\text{Ratio } \frac{\text{Air}}{\text{Oil}} \text{ by weight} = \frac{\rho Va\ n}{w}$$

where w = weight of oil used per minute in the engine, as measured on the trial.

NOTE.—The diagram shown in No. 13 is rather interesting. When the mixture valve is admitting too much air the engine frequently fires back through the air inlet pipe (this effect being well known to motorists as a "carburettor blow-black," usually the result of an impoverished mixture), the indicator diagram showing exactly what happens. It may be explained by reference to what occurs on turning a gas stove cock off quickly, the mixture of air and gas being weakened until a mixture is obtained which will explode at atmospheric pressure.

INTERNAL COMBUSTION ENGINES FOR MARINE USE.*

THE object of this paper is to raise a discussion to elicit the opinions of members, in the type and design of the standard marine internal combustion engine of the future. We are not yet in sight of the gas engined battleship or Atlantic liner, but steady progress is being made with engines of small power, and the problem of larger powers is now being tackled by several engineers. The first question which arises is: Will the engine of the future be a gas turbine?

As there are, so far as the writer is aware, no practical examples of such a machine in use, the probability is that the reciprocating type of engine will be developed first, at any rate, until something practical is evolved in the way of a gas turbine. The first consideration is that of fuel.

The fuels at present used in connection with internal combustion engines are coal, anthracite and bituminous, coke, crude petroleum, paraffin, petrol and alcohol. For commercial marine use cheapness of fuel is essential, and the choice would naturally fall on coal, except in certain parts of the world near oil fields, where it would pay to use crude petroleum. Petrol is quite out of the question owing to its prohibitive cost. Coke, unless sold as a bye product, would be too expensive. Alcohol may perhaps in the future be able to compete with petroleum.

The use of coal as a fuel involves, of course, the provision of a gas producer and its accessories, and in preparing a plant composed of engines and gas producers, with a plant using petroleum direct, either on the Diesel, or vaporizer system, due account must be taken of the additional space required for the former plant, its extra cost, and the value of the extra space occupied, compared with the dearer fuel of the latter plant.

The most successful gas producers from the point of view of easy and reliable working are those using anthracite fuel. On account of the extra cost of this fuel, as compared with ordinary bituminous coal, it will be essential, if the best fuel economy is to be obtained, to have producers capable of dealing with all qualities of bituminous coals such as are now sold as steam coal. At the present time, owing to the trouble caused by the formation of tar and other difficulties, producers dealing with bituminous fuel are not entirely satisfactory, but no doubt in the near future, the necessary improvements will be effected to enable ordinary bituminous steam coal to be used successfully.

The next question to be considered is, which type of internal combustion engine will best fulfil the somewhat difficult conditions imposed by marine necessities?

These conditions are—

(1) Absolute reliability.

(2) Capability of continuous non-stop running for long periods.

(3) Capability of running in either direction and of being started with absolute certainty from any position of the cranks, without the use of barring gear.

(4) Capability of working economically at various speeds.

(5) Complete accessibility of all working parts for examination, overhauling and repair.

With reference to the first two conditions, great advances have been made of late years, in this direction.

Greater attention has been paid to arrangements for lubricating the various working parts satisfactorily, ignition methods have been improved, and details generally brought to perfection.

There are, however, some difficulties to be overcome yet, mainly due to producer troubles and unclean gas causing deposits of tar and other impurities on the valves and internal working parts.

Coming to the third condition, *viz.*, capability of running the propeller in either direction and of being started from any position without the use of barring gear, this brings us to one of the greatest difficulties experienced in adapting the internal combustion engine to marine use.

There are two ways of tackling the problem. First, by running the engine in one direction only and interposing some kind of coupling between the crank shaft and the propeller shaft, by which reversing of the rotation of the propeller shaft may be effected, or, second, by the direct coupling of crank and propeller shaft as in a steam engine and making the engine itself capable of reversing. Several methods of carrying out the first arrangement have been used and proposed, a few of which may be mentioned here.

There is the ingenious Paragon system of our member, Mr. William P. Durtnall, in which an electric dynamo and motor are interposed between the crank shaft and the propeller, by which reversing and also speed variation are effected. For smaller powers bevel gearing has been used to effect the necessary reversing motion.

Other systems which have been suggested are the interposition of an hydraulic pump and motor between the crank shaft and propeller shaft, and Mr. Dunlop's system, in which the connecting medium is compressed air where reversing is effected by gearing, some form of clutch is generally used, which also enables the engine to be started up with no load on. For small powers, there is no vital objection, except that of complication, against clutches and spur gearing, but when larger powers have to be dealt with, there are serious mechanical difficulties to be overcome, and these difficulties have induced engineers to study electrical, and other methods of coupling.

In the writer's opinion all these coupling devices are more or less temporary measures rendered necessary in order to adapt the internal combustion engine as used for stationary work to the different conditions required for marine work.

Sooner or later on the score of simplicity and cost, all gearing between the crank shaft and the propeller shaft will be abolished, the engine being coupled direct as in a steam engine.

The present systems, actual and proposed, may be considered as a stage on the road towards direct coupling. In the early days of steam marine engineering, gearing was used between the crank and propeller shafts to keep down the speed of the engine to what was in those days a standard.

It was only a question of time to make the necessary modifications to the engine to enable it to run at the same speed as the propeller. In the same manner marine engineers will now, no doubt, set themselves the problem of making the internal combustion engine into a satisfactory reversing machine with adequate provision for speed variation, thus dispensing with all gear and enabling the crank shaft to be coupled direct to the propeller shaft. Fortunately, in this case, the revolutions most suitable for the propeller are also suitable for the engine, and there is no need to make compromises as regards revolutions, or adopt reduction gearing as in the case of coupling up a steam turbine and propeller.

As regards the fourth point, *viz.*, capability of working economically at various speeds, the conditions to be fulfilled are certainly difficult, if the internal combustion engine is to be made as flexible as a steam engine.

The principal difficulty lies in the relation between the revolutions and power required for driving a ship at various

*Read by Mr. W. R. Cummins, Member of the Institute of Marine Engineers, in the Hall of the Garden Club at the Japan-British Exhibition, on June 25, 1910, the Hon. Wm. Hall-Jones, High Commissioner for New Zealand, in the chair.

speeds. The horse power falls at a much more rapid rate than the revolutions, as the speed of the ship is reduced. In a steam engine this reduction of horse power can be effected by cutting off earlier, and thus decreasing the mean pressure.

In an internal combustion engine any decrease in power, outside of that given by reduction of revolutions must be effected by cutting out explosions, or varying the strength of the explosive moisture, or both. In mercantile marine work sufficient reduction of the power for the range of speeds required can be effected by either of the above methods separately, or combined. We can now proceed to discuss the type of engine which will best lend itself to the stipulated conditions. The choice lies between double acting or single acting cylinders, two stroke cycle or four-stroke cycle engines.

The adoption of double acting cylinders, although used on gas engines of a certain type for land use, would in the writer's opinion be a risky proceeding. It entails arrangements for cooling the piston and piston rod by water circulation, and trouble might arise from the use of salt water for this purpose.

The two-stroke cycle has so many advantages over the four-stroke in fulfilling the conditions laid down that it would appear to be far and away the more suitable for marine work. In the first place it will run equally well in either direction, with adjustment of the ignition. This simplifies the reversing problem immensely. In a four-stroke engine reversing gear would be required for the inlet and exhaust valves. Also, as the two-stroke has an impulse every revolution, the cutting out of an explosion will have just half the disturbing effect on the uniformity of turning as that of a four-stroke. There are several other advantages of the two stroke over the four stroke, which may be enumerated here.

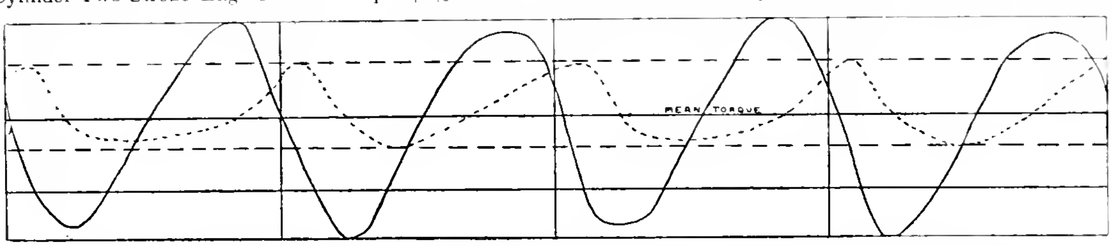
but at the same time it is important that the fly-wheel effect be as small as possible, so that the engine may be stopped and started as quickly as possible. Here, again, the two-stroke has the advantage.

In order to show the excessive torque variation in a four-stroke engine, the diagram herewith has been prepared in which a comparison has been made between a four-crank, four-stroke engine and a two-crank, two-stroke engine. It will be seen that the range of torque variation is greater per cent. in the case of the four-stroke than is the percentage in the case of the two-stroke.

Since the advantages of the two-stroke engine compared with the four-stroke appear to be so obvious, one naturally asks the question why this type has not already displaced the four-stroke. The four-stroke engine was first in the field, and thus had a good start in securing the market. The two-stroke engine, of course, requires a pump to force the charge into the power cylinder. In some of the earlier types of two-stroke engines this pump was separate and worked by a connecting rod from the crankshaft.

This system is used on the Oechelhauser engines as now made. The use of a separate pump has been urged as an objection against the two-stroke engine, the argument being that the four-stroke is so much simpler, as the power cylinder also performs the function of the pump of the two-stroke engine. A large number of makers of two-stroke engines of small-power now use the front end (*i.e.*, the end nearest the crank shaft) of the power cylinder as a pump. This of course, simplifies and cheapens the engine. The principal difficulty, however, experienced with most types of two-stroke engines, is that of pre-ignition. It is a very usual practice to use the incoming charge to expel the hot gases through the exhaust ports, the result being that if a high compression pressure be

4-Cylinder Four-Stroke Engine Max. Torque 80% Greater than Mean, Min. Torque 106% Less than Mean. Range 186%.
2-Cylinder Two-Stroke Engine Max. Torque 46% Greater than Mean, Min. Torque 28% Less than Mean. Range 74%.



Full Line shows Turning Moment or Torque for 4-Cylinder Four-Stroke Engine with Uncushioned Reciprocating Parts,
Dotted Line shows Torque for 2-Cylinder Two-Stroke Engine with Reciprocating Parts Cushioned

In the first place a cylinder of certain size, arranged as a two-stroke, will give twice the power of a cylinder arranged as a four stroke, provided the number of revolutions is the same. This means a large reduction in the weight and cost of the two-stroke for a given power. Also an engine of certain size arranged as a two-stroke will develop the same power as an engine with same size cylinders arranged as a four-stroke, at half the number of revolutions. This is an important consideration in engines of small power, as a slower running and more efficient propeller can be adopted with engines of same weight and cost as the four-stroke type.

In the second place, as the two-stroke engine exhausts through ports in the cylinder wall the hot gases do not pass through a valve. In the four-stroke engine the gases pass through a mechanically operated valve, and it has been found necessary, in engines of quite moderate power, to have this valve water cooled. This entails a lot of complication, including flexible water connection to the valve spindle. Here, again, there would probably be trouble if salt water were used for cooling purposes.

In the third place the impulse every revolution gives a vastly improved crank shaft torque over that of the four-stroke engine, permitting of a lighter fly wheel and crank shaft. It is difficult to get a fly-wheel effect in a marine engine, owing to the very limited diameter of wheel possible and the small number of revolutions.

The fly-wheel effect varies as the weight, and as the square of the speed of the rim, consequently a small diameter wheel entails a large weight to give the necessary effect. An irregular torque is said to be detrimental to propeller efficiency

used, the charge is liable to be fired by the hot gases remaining in the cylinder, after the piston has covered the exhaust ports. It is not practicable to expel the whole of the hot gases, as the volume of the charge admitted would require to be such that there would almost certainly be a loss of some of the charge through the exhaust ports. Pre-ignition may and does occur occasionally in four-stroke engines, as in ordinary designs there is always the volume of the combustion space left filled with hot gas, but there is more time for this gas to get cooled down before compression begins than in the case of two-stroke engines. The result is that two-stroke engines are generally run slower and with less compression than four strokes their advantages being thus to a large extent discounted. The remedy for these faults lies of course in providing for scavenging the power cylinder by cold air before the admission of the new charge.

Many methods have been proposed and used to effect the complete removal of the hot gases before the new charge is admitted. Two systems are in use, *viz.*, the vacuum system and the pressure system. The first system aims at creating a partial vacuum in the cylinder at the end of the exhaust stroke by a pump or other means. Other systems create a partial vacuum in the exhaust pipe and allow cold air to pass through the cylinder and flush the combustion space. This latter system is adopted by Messrs. Crossley Bros., who use a long exhaust pipe by which they obtain a partial vacuum by the intermittent action of the exhaust. When the air inlet valve is opened air flows into the combustion space and expels the hot gases through the exhaust valve. The pressure system by which cold air is supplied under a light pressure

appears to the writer to be the more effective system. It is this latter system which is carried out successfully in the Eochelhauser two-stroke engine. In other two-stroke engines, such as the Day and a large number of similar type used in America, the crank chamber is used as a receiver for the explosive mixture, the front end of the power cylinder being used as a pump.

On the in-stroke the piston draws explosive mixture into the crank chamber through a valve, and compresses the mixture to a few pounds pressure on the out-stroke. The exhaust ports are arranged on one side of the power cylinder and the inlet ports on the opposite side. The exhaust ports open first and relieve the pressure in the cylinder. The inlet ports are then opened and the mixture flows into the cylinder, displacing the exhaust gases through the exhaust ports.

A rib is cast on the piston opposite the inlet port to deflect the incoming mixture away from the exhaust port in the hope of preventing the charge from escaping to the exhaust. This system has several drawbacks, notably the use of the crank chamber as a receiver, owing to the difficulty of making it absolutely gas tight, the chief trouble being the leakage past the shaft when the bearings are worn.

Owing to the risk of pre-ignition, due to the large volume of exhaust gases which cannot be expelled without the chance of losing a good deal of the incoming mixture, the compression pressure and speed of these engines must be kept very low. They have, however, the merit of extreme simplicity, being practically valveless.

The next point the writer wishes to raise is that of cushioning the weight and inertia forces of the reciprocating parts. It is a point which should appeal to all marine engineers. In steam engines the compression is adjusted in such a way that the reversal of the load on the crank pin when turning the dead centre shall be as gradual as possible near the end of the stroke, the reciprocating parts requiring a certain definite force to bring them to rest. This force depends upon the weight and number of revolutions, and the same force is required to start them up again on the return stroke. This force is irrespective of, and additional to, any pressure on the piston. If the piston is not cushioned this force is expended on the crank pin and the main bearings, and to no purpose, as it cannot exert any turning force on the crank shaft. All it can do is to pound the bearings. If, however, the piston is cushioned, say, for example, the compression pressure is such as will just balance the inertia forces, then the crank pin will turn the centres without shock. It is not usual in internal combustion engines to provide means for cushioning the reciprocating parts. It is true they are cushioned on the compression stroke, but in a four-stroke engine that is only one stroke in four, and in a two-stroke the in-strokes only are cushioned. The magnitude of these forces is not always realized, so an example may be given here.

Taking a cylinder 20 in. diameter and 24 in. stroke at 160 revolutions, the force required to stop and start the reciprocating parts, is on the top centre $7\frac{1}{2}$ tons and on the bottom centre 5 tons approximately, which is equivalent to 53 lb. per sq. in. on the piston at top centre, and 35 lb. per sq. in. on bottom centre.

These unbalanced forces acting on the crank pin and main bearings no doubt account for a great deal of the mechanical inefficiency of the gas engine as compared with a steam engine. The writer suggests that engines for marine work should be cushioned by means of an air cylinder.

If a two-stroke engine is adopted it will be only the down-strokes which will need to be cushioned, the up-strokes being cushioned by the compression of the charge in the cylinder.

For a two-stroke engine a pump cylinder is necessary for dealing with the mixture, and this same cylinder can be utilized for cushioning on the down-stroke. If this pump cylinder is made as an extension of the power cylinder the objections as regards cost and space occupied by a separately driven pump are overcome, and the three operations of pumping the mixture into the power cylinder, supplying a scavenging charge, and cushioning the reciprocating parts on the down stroke, can all be performed by this one pump cylinder.

A further advantage gained by cushioning with an air cushion is that the reciprocating parts are started up again on the return stroke, and the engine is to a certain extent made double acting With uncushioned reciprocating parts the crank pin has not only to stop the motion of the moving parts at the end of the stroke, but also to start them up again. When, however, cushioning is carried out, the crank pin is relieved of this duty.

In ordinary internal combustion engines every endeavour is made to cut down the weight of the moving parts in order to save the crank pin and bearings from these inertia stresses. Now the indicator diagram of this class of engine has a very high initial pressure due to the explosion, and a very rapid fall of pressure due to expansion and cooling of the gases. As the explosion takes place at the beginning of the stroke the crank pin has very little effective leverage to produce torque on the crankshaft, the result being heavy pressure on all the brasses, with very little effective work performed. If, however, the inertia forces are large—suppose, for instance, they are equivalent to a pressure on the piston one half of that produced by the explosion—then the load on the bearings would be reduced to one half of what it would have been if the moving parts had no inertia. This would give a much more effective distribution of the load on the crank pin, relieving it of the heavy initial stress due to the explosion, which would otherwise come on it, and retarding the effect of the initial pressure on the piston until the crank and connecting rod are at a more favourable angle for producing torque on the crank shaft. Another advantage of the cushioning is that a certain portion of the negative work of compression can be effected by the cylinder itself without any help from the crank shaft, as the work stored up in the cushioning air during the down power stroke is given back to the piston on the up compression strokes. If the air cushion pressure required to balance the inertia of the moving parts were equal to that of the compression then the whole of the work of compression could be effected in the cylinder, without the intervention of the crank shaft. This should tend to increase the mechanical efficiency of the engine, as the transfer of work by means of the alternate compression and expansion of air should be more efficient than the transfer by means of the crankshaft and connecting rod.

We have next to consider whether there is any loss of efficiency involved in this alternate compression and expansion in the cushioning cylinder. If the air is compressed and expands adiabatically and there is a leakage, the only loss of efficiency is that due to mechanical friction of the piston. There will be a certain loss of efficiency if the compression is not adiabatic; that is to say, if there is a continuous loss of the heat developed by compression. This, however, should be very small, as in the first place the alternations of temperature due to compression and expansion will be very rapid, and there will be very little time for the heat in the body of the cushion air to be transmitted to the walls of the cylinder and through them to the external atmosphere. In the second place the greatest temperature will be developed at the end of the stroke, when the surface exposed is at its minimum; and, thirdly, the average temperature of the surfaces, assuming them to follow the temperature of the air, will not exceed about 200° F. with a compression pressure of 50 lb.

The next question to be considered is that of starting and reversing. If there is no clutch between the crankshaft and the propeller shaft, a considerable amount of stored energy in some form will be required for the operations of starting and reversing, and when considering this question, the method of working the auxiliary machinery should also be considered with a view of adopting the same plant for both purposes.

The choice of the motive power for the auxiliary machinery, *viz.*, water pumps, bilge pumps, ballast pumps, service pumps, winches, steering gear, windlass, refrigerating machinery and ventilating fans and electric lighting lies between steam, electricity, and compressed air. The use of steam would be a step backwards and would not be suitable for starting and reversing purposes. Electricity would be suitable for all pumping work, refrigerating machinery, fans, electric lighting and steering gear, but it has not yet been adopted to any extent for deck machinery, for which compressed air would no doubt, be suitable. There are difficulties in using compressed air expansively, but these can be overcome by reheating the air before use. There is plenty of waste heat for this purpose.

The writer's suggestion is that the starting and reversing gear should consist of a high-speed internal combustion engine, coupled direct to an efficient air compressor, which

would deliver into a receiver, from which air would be taken for manœuvring the engines and working the deck machinery, and any other auxiliaries suitable for compressed air. For the remainder of the auxiliary machinery, a high-speed internal combustion engine, coupled to a dynamo supplying current for lighting purposes, and for all the other auxiliaries. The air compressor would be running only when working the cargo and manœuvring in and out of port, the compressed air receiver containing sufficient air for emergency purposes.

The only other question remaining for discussion is the number of cylinders to be adopted and their disposition, having regard to limits of size and facility of handling. By adopting the two-stroke engine with its impulse every revolution, twice the power can be obtained from a cylinder of the maximum diameter allowable than from a four-stroke cylinder. Tandem cylinders are inadmissible as they would entail a piston rod exposed to the hot gases of the explosion, and double acting cylinders are unsuitable for the same reason, so that for large powers the number of cylinders will need to be increased to keep within the limits of the maximum possible diameter.

For ordinary mercantile work the stroke may be made relatively long and the revolutions should be made as high as possible consistent with propeller efficiency. For engines of small power the number of cylinders should, of course, be as few as possible, and the minimum number will be fixed to a great extent by the question of facility in starting and reversing.

The conditions are that the engines must be able to start in either direction, by simply turning on the compressed air. By utilizing the bottom end of the pump cylinder for cushioning, the advantage is gained that air can be admitted under the cushioning piston to give an up-stroke, which is additional to the down-stroke given by admitting air to the power cylinder. The minimum number of cylinders with this arrangement would be two; with a four-stroke engine uncushioned, the minimum number would be four. To get the best turning movement and balance with the two cranks they should be opposite one another, but this would not be the best position for certainty of starting up, as they might both be on the dead centre. Under normal conditions, however, when the ignition is cut off for stopping the engine, the action of the cushion air on the down-stroke and the compression on the up-stroke will make the engine stop with both pistons at half stroke. There is a remote contingency that they might stick on the dead centre, and for small engines a simple barring gear could be provided for this emergency. For engines of larger size three cylinders with cranks at 120° would make an ideal arrangement. The engine would start in either direction, irrespective of the position of the cranks, although under normal conditions, the engine would stop with one of the pistons at about half stroke.

In using compressed air in this way for starting and reversing it is important to have the starting valves on the cylinders controlled automatically for two reasons—*viz.*, to ensure that the correct valves are opened to give the desired direction of rotation, and to prevent waste of the compressed air, such as would result, for instance, if air were admitted to a cylinder when the exhaust ports were uncovered, when there would be a straight blow through to the exhaust pipe. The reversing gear must also work the ignition timing apparatus which will make the necessary correction for ahead and astern running.

The writer has not attempted in the limits of this paper to go fully into details, but has merely outlined a few ideas for the criticism of the meeting. In conclusion, therefore, he ventures his opinion that—

1. The internal combustion plant of the future for marine work will consist of bituminous fuel gas producers, supplying gas to two-stroke cycle engines.
2. That crude petroleum will be used where it can compete in price with coal. It will operate in two-stroke cycle engines of the Diesel or vaporizer type.
3. That effective means will be taken to scavenge the power cylinder with cold air.
4. That some method of cushioning the reciprocating weights will be adopted.
5. That the crankshaft of the engine will be direct coupled to the propeller shafting without the intervention of gearing of any kind, except in the case of engines of very small power.
6. That manœuvring will be effected by compressed air, which may also be used for working the deck machinery.

JAPAN-BRITISH EXHIBITION.

THIS Exhibition is now in full swing, and is an improvement over that of last year, alike in regard to its general and specific features. There is much to interest and instruct the public eye, both in respect to Japanese and British industries, and to the historical associations of the two empires, the meeting of the East and the West with the fusion of Western ideas and education into Eastern life. It is stated that the first Englishman located in Japan was Will Adams, hailing from Kent, who landed, a shipwrecked mariner, in 1600, and lived there till he died in 1620. The name reminds us of a namesake whose exploits at Waterloo have been proclaimed in our ears at sundry times. The better way to enter the Exhibition is by Shepherd's Bush and leave by Wood Lane, as by so doing some interesting features of Japan may be seen in the long annexe, which two years ago was devoted chiefly to the vineyards of France. The Machinery Hall claims our special attention, and we commend our readers to the guide-book for information on the general situation and particulars of what is worth seeing; a study of the guide-book before-hand will save time, economise labour, and add to the value of the visit.

The Building Yard, Dry Dock and Workshops at Nagasaki are well illustrated by means of a large diagram representing these, with raised ground-work, showing also vessels on the stocks in various stages of construction, with the scaffolding poles around them. There is a fine full model of one of the largest steamers built in Japan, running on the American route. The large photographs of the interior of the workshops reveal the up-to-date system on which the work is carried out. The raised diagrams of Tokio and other cities, Formosa with its extensions of harbour and other works, show the enormous progress made, when one contrasts the appearance presented now with the recollections of thirty-five years ago.

Messrs. Armstrong, Whitworth & Co. have some excellent exhibits of their workmanship and specialities.

Messrs. Ferguson Bros. Messrs. Lobnitz and Messrs. Simons, Renfrew, are each represented by models and illustrations of their well-known dredging plants, set out in the spaces occupied by these firms in the Machinery Hall.

The Railway Companies are well represented, and the cinematograph of the London & North-Western is as popular as on former occasions. It is situated in a building in the grounds.

The Hydraulic Engineering Co., Chester, have several samples of their manufacture, electrically driven and other pumps, special lubricator for hydraulic plant and other details.

The Beldam Packing Co. have a neat stall showing samples of their manufacture, and also a model of the Willett Bruce Steam Whistle apparatus for giving clear and distinct blasts and timed signals. Attention is further called to the Trident Fire bar, which is being largely adopted for marine boilers.

Messrs. Hopkinson show some of their specialities and a large sample of the Feranti Stop Valve, the merits of which are well known and appreciated by engineers.

Messrs. Babcock & Wilcox have a model conveyor at work, with tipping buckets and automatic lubricator, besides exhibits of Water Tube Boilers and other details of interest.

Messrs. Hans Renold, of Manchester, who are specialists of a very high order in the manufacture of driving chains, have a stand in the wing of the Hall, near the fine display of textile machinery, which occupies the centre space and at certain times is in motion, here carding, winding and weaving machinery are on view and of excellent workmanship. Opposite the machines of Messrs. Dobson & Barlow, Bolton, which ought to be seen at work, is the stand of Messrs. Renold, where are shown samples of all kinds of chains for driving machinery from rollers to cycles and a set of every type of cycle chain. One of the commendations of this firm's manufactures is that, amid the variety of style to suit the different requirements of the drive there is but one quality of material and workmanship, that is the best. There are chain drives on view for powers ranging from 3 to 40 H.P., and speeds from 400 ft. to 1300 ft. per minute.

The silent drive by the latest type of chain is provided with a shock absorbing sprocket, and is shown with part of the cover plate cut away to expose one of the springs. This type is specially adapted for a drive where the load is impulsive, as in pumps, compressors, and forging machines. An illustration is shown of the largest and smallest sizes of mortices on wood blocks; also a Morticing Machine chain outfit with guide bar and Sprocket. Those interested in this class of work would do well to examine these.

Excellent photographs of the works are on the walls of the stand, and serve to indicate the magnitude of the operations carried out by Messrs. Renold, by means of which they have earned their well-won reputation. Descriptive pamphlets in English, French and German may be obtained at the stall.

Near the L. & N.W. Railway exhibit in the Machinery Hall is a neat stall occupied by Messrs. Wailes, Dove & Co., whose well-known "Bitumastic" enamels, coverings and solutions for protection against the ravages of corrosion and deterioration have made them famous the world over. Models of a midship section with the framework, and of a workshop, showing the details coated with the different "Bitumastic" composition specially suitable for each, an excellent method of illustrating an answer to those interested in the question of how to prevent deterioration and arrest corrosion. Another model shown is the application to ship's deck-plating of "Bitumastic" covering over corticene, similar to that applied so successfully to the promenade and other decks of the *Mauretania*. This material, and others of a like character, have come into use during the last few years in preference to wood for laying over steel deck-plating, on grounds of economy and convenience. It is readily applied, requires no holes through the plating or bolts, is therefore less liable to leakage and a better protection to the steel work, is durable if properly laid, besides being more sanitary than wood, than which it is lighter—a consideration in cargo ships especially. The application of "Bitumastic" on the covering gives it a good firm surface and finish. The *Mauretania* and *Lusitania* are quoted as examples where the "Bitumastic" compositions have been applied for preservative purposes, and there are many other steamers which have thus been kept sound and good in the stokehold framework and bunkers. The use of "Bitumastic" also for land work has been extending; Bridges, Tanks, Pithead Gears, Refrigerator Plant, Roofs and other structures. Medals and Diplomas from several exhibitions have been awarded to Messrs. Wailes, Dove & Co. for the excellence of their compositions. The London address is 10/11, Lime Street.

The India Rubber, Gutta Percha & Telegraph Works Co. have a large stand, where samples of their manufactures are displayed. The variety of design shown in india-rubber paving for passages, halls, bath-rooms and pantries is very great, and the choice offered to possible customers admits of a selection to suit any taste or satisfy the harmony of any colour. The service rendered by this firm to the community is very great, both land and sea exact contributions, from golf balls to waterproofs, from dynamos to packings, with every class of goods into which rubber enters in one form or another. The London address is 110, Cannon Street.

Yearly Volume, XXXII.—With this number Volume XXXII of "The Marine Engineer and Naval Architect" is completed. The bound volumes, August, 1909, to July, 1910, will be ready shortly, price 7s. 6d., or by post securely packed, United Kingdom and Canada 8s., other countries 8s. 6d. Binding cases may be obtained from the publisher, price 1s. 6d., carriage 3d. extra. The index to vol. xxxii. will be published with the August issue.

LLOYD'S RULES FOR INTERNAL COMBUSTION ENGINES "Lloyd's Register of British and Foreign Shipping" will shortly issue rules for the survey of internal combustion engines for marine purposes. The rules have just been adopted by the Committee of the Society, and will greatly simplify the registration of the increasing number of vessels fitted with oil engines. The rules are divided under four headings, *viz.*, construction, rules for determining sizes of shafts, fuel tanks and inspection and periodical surveys.

CORRESPONDENCE.

We do not hold ourselves responsible for the opinions expressed by our Correspondents.

To the Editor of THE MARINE ENGINEER AND NAVAL ARCHITECT.

Re Electrical Propulsion of War-Ships.

Dear Sir,—My attention has been drawn to a most interesting article on the above subject in your June issue, and I would respectfully add a few remarks of my own in response to same.

Your correspondent remarks that my recent paper before the Institution of Naval Architects gave some extensive views in connection with electrical propulsion, and that I have since followed up the matter in "Engineering" in reply to some correspondence that has been going on in that journal on the subject. He states that I have high ideals in this connection; well, sir, I will say that I have, and that they are the result of a very large amount of consideration on the subject of ship propulsion by other means than that which has for the last fifty years been in operation, to the detriment of the shipping industry, and which has at last led the same industry to be almost at the bottom of the commercially sound organizations in this country.

I repeat that if economy in fuel is required for ship propulsion, which means a greater steaming radius, for both full speed, and also for the cruising speed, and that by the use of superheated steam, the weight of the boiler and propelling machinery can be reduced, with safety, therefore bringing about, that lighter draught can be secured for a given vessel, producing the same thrust and therefore higher speed. If quick handling, and if a heavy torque or speed is required on all propellers in ships of war, then electricity must be used for propulsion. The reasons are fairly given in my recent paper, and also the one that I read before the Institute of Marine Engineers at the Franco-British Exhibition in 1908, and again before a large gathering of naval engineers at Chatham in May, 1909. In the latter case I took for my subject the case of the *Dreadnought*, and in which I showed that by means of the "Paragon" system of propulsion that a saving in fuel could be made, equal to 26 to 27%, as compared with the published figures of that vessel. This economy could be brought about also with less top hamper and funnelage, etc., giving more room for gun operation, and also more room in the vessel for quarters, etc. The discussion that followed was appreciative of the ideas, and confirmed the views that I held on this subject as applied to such vessels. Many engineers of practical sea-going experience spoke at this meeting, and with whom I have since had the pleasure of meeting, and I am pleased to state that the naval engineers would have no hesitation in applying my system now they understand same; it was not clear to them at first, but now they see the subject in a much clearer light. There are many that say the electrical propulsion of large naval ships must come.

It was before the Institute of Marine Engineers that I first made my investigations public, in 1908, and the matter was discussed at no less than three different meetings after, and I am firmly convinced that marine engineers generally are more acquainted with the subject of ship propulsion by electricity since the paper was read and discussed. What better proof is required of the real merits of this method of propelling ships, than as may be soon ascertained by reference to the patent application lists since that date, when it will be seen that a large number of firms of high repute in this country and abroad are applying for British patents for electrical propulsion. In the face of the discouraging remarks made by Mr. Charles A. Parsons at the discussion on my paper at the Institution of Naval Architects last March, he himself is now trying to get a patent for electrical ship propulsion, in which high-speed steam turbines, in conjunction with low-speed propellers may be used. This is covered by my original patents in 1905, quite apart from my patents of 1908. It is true that nearly everyone made much fun of my suggestions as to the propulsion of large vessels by the modern prime-movers, such as steam turbines or internal combustion

engines, by means of running them at high revolution speed, therefore getting a large amount of power for, comparatively speaking, low weight, and even now in some quarters it is not quite understood how this comes about, in the face of the papers and lectures that I have given on this subject, and this, only with a view that the engineers who have been brought up with plain steam plant should learn more about the electrical side of the counter. I realize that unless the engineer knows more about the possibilities of heavy electrical engineering, very little progress would be made in this direction, and such was the object of my endeavours that have since been made in nearly all parts of the world.

Your correspondent refers to a suggested scheme in America, in which it was proposed to employ electricity for propulsion of a large naval vessel; the figures that are given are those taken from the paper on the subject that was read by Mr. Emmett (the chief turbine engineer of the General Electric Company in New York) before the American Institution of Naval Architects and Marine Engineers in New York, last November, and there is not the slightest doubt that the figures are right, and that there is a great saving in fuel to be made, and also of weight of plant, by the adoption of electrical driving for such vessels. They were compared with a set of Parsons type of plant for the comparison, and the particulars were, as quoted by your correspondent, which show an enormous saving. The full speed was taken at 21·2 knots and the cruising speed at 12 knots; I do not agree that a speed of 18·5 knots would be the cruising speed of an ordinary naval vessel, unless the conditions are that steam turbines direct coupled are employed; in that case the steam consumption would be very high, because of the lower revolution speed of the turbines which would put the steam consumption up to a very large extent. This was the reason of showing the steam consumption at 12 knots for the cruising speed, which is favoured by many, and is possible in reciprocating engined vessels, but cannot be brought about with any economy in direct-coupled turbine-driven ships, but such low vessel speed can be obtained with great fuel economy, as Mr. Parsons admitted in the discussion on my paper, by the use of electricity for driving ships.

The increase in propeller efficiency at a higher revolution speed than is at present possible, is one of those things which will be welcome in many directions. As your correspondent points out, there would be no reason why the revolution speed should not then be taken up to say 350 R.P.M., with perhaps the same thrust per horse-power delivered at the shaft as at 240 R.P.M., but this advantage would be all the more welcome in the electrically-driven boat as the electric motors would be smaller, lighter, and lower in cost, and in some cases the efficiency of the motors would be raised. The turbine would in that case be raised still further in revolution speed, for the same number of poles in the motor, so that a further saving would take place in steam per brake horse-power delivered by the turbine, and in the end the overall steam efficiency would be increased in the electrically-driven boat, especially as compared by the amount of steam used per thrust or effective horse-power for propulsion.

As your correspondent states, the matter of a still smaller diameter turbine would apply equally as well to the electrically driven boat as to the direct-coupled turbine-driven vessel. Further the higher revolution turbine, as suggested in the electrically-driven vessel, would enable the use of superheated steam of a high temperature, and thus would make a saving in fuel that is debarred in the direct-coupled job. As is well known the use of superheated steam of a very high temperature is not only dangerous but could not possibly be employed in large diameter (comparatively) direct coupled steam turbines, so it comes about that the electrically-driven boat has inherent advantages that are not to be found in any design of direct-coupled steam turbine drive. The extra weight of superheaters would not be near the amount of dead-weight saved by the allowance for weight of the boiler-room plant, by the amount that represented the amount of steam saved per horse power developed, between saturated steam at say 350 degrees Fahr., and say 600 degrees Fahr. steam.

Your correspondent states that apparently I favour the use of twin screws for vessels of large power; this is not correct; as he states, the diameter of propeller allowable in any particular case decides the matter of the number of screws that may be used in electrically driven ships just as much as it does in any turbine or reciprocating-engined ship; one of the things that the electrically-driven ship embodies is the fact that either one, two, three, four, or even five propellers can be used according to circumstances as the naval architect may desire, and the amount of power it may be desired that the propeller shall deal with. At the same time also, according to circumstances, the number of electrical generators and prime-movers that are used may also be independent of the number of propellers. For instance, suppose it may be desirable to use internal combustion engines for generating the mechanical power, it can be easily arranged with efficiency, that, say, three gas or oil engines may drive one screw propeller for propulsion, so splitting up the generating plant as may be desired. This is a very interesting thing from many aspects, considering that the internal combustion engine at the present time is not to be got in extremely large powers that are required for marine engineering practice. Further it can be arranged in a case like the big Cunarders, that, say, six steam turbines using superheated steam may be employed to drive the four propellers (see "Electrician," June 10th, 1910), thus splitting up the prime power in more economical units, and also that they shall be all of one design and therefore requiring one set of spare parts to be carried. Standardization is one of the things that the future marine engineer must give attention to if he is to avoid the expenditure of unnecessary capital.

A thrust block will be used in the electrically-driven ships, and so it will come about that the full torque can be given in either direction of revolution speed, whether just reversing or running at top speed in either ahead or astern direction, and this on all shafts; this alone must be considered a great advance on the existing methods of steam turbine-driven ships—no marine engineer will admit that such conditions can be met in any other way, with the exception of the use of reciprocating engines for the purposes of driving and controlling propellers. The electrical method of the "Paragon" system meets this condition, because when reversing, the current is supplied at a low frequency to the motors, thus producing a very high torque when it is required, *i.e.*, the moment of reversing the propeller, perhaps when the vessel is travelling at high vessel speed ahead, and these conditions cannot be met in the case of ships that have direct-coupled steam turbines, as generally the reverse turbines are mounted on the ahead turbine shafts, and consequently the momentum due to the quickly revolving rotors of both the ahead and the reverse turbines running in the ahead direction, has to be broken down before any effect of the steam is felt on the actual work of reversing the propellers, and this is where the electrically-driven war-ship would come in, especially in close action; it would be round and round the ordinary turbine vessel like the proverbial "Cooper" round the cask. Having a higher speed for the same displacement, because of the extra power that may be got for a given bunker capacity, or fuel consumption it could pick and choose the range of action as it liked, or if the same speed is desired, then the saving in weight may be made up in either extra gun power or thicker armour, as may be the desire of the naval constructor.

The engineer is not usually called in to give his views of the tactical value of 20 against 25 knots as regards speed, but the writer is certain that speed is one of the things that the naval constructors must study in the early future, and it will well repay a little attention to the electrical direction of getting it. It must be also remembered that the electrically driven vessel will make a great saving in the room on the boat if properly laid out, as it is obvious that the turbine generators need not essentially be placed in direct line with the propeller shafts; it may even come about that such plant can be placed over the propeller shafts and the motors forward; in fact the electrical method is so elastic in its adoption and disposition that it may be arranged in many ways to meet the conditions laid down by the naval architect. My views are these, that the electrical plant may be split up in so many small units that the strength of the hull or the weight of metal in same can be reduced, and this saving of weight is an item to be considered.

I quite agree that the *personnel* of the electrically driven ships will be different from the present methods; in fact I would only allow the "Paragon" system to be placed on board a vessel for main propulsion in which the marine engineer had previously undertaken a study of polyphase

alternating current electrical machinery, together with superheated steam turbines running at high speed, as used in central stations on land; as for placing the plant such as would be required for propelling a modern war-ship in the hands of a torpedo officer, with no training in heavy electrical engineering, the idea itself is amusing, apart from the fact that it would be unpractical. The result of my lectures at Chatham tells me that engineers in the naval service are very intelligent men, and during the construction of the first plant for propulsion of such a vessel, I am certain that sufficient instruction would be instilled into them to enable them to take charge, and that there need be no necessity to draw in such a bogey as having two heads to the engineering department; as your correspondent points out, if such were the case, the result would be better imagined than described; no, sir, on the boat that will be fitted with my system, the engineer in charge of the machinery will know his work thoroughly, and will be boss.

I am also certain of another thing, that it would be to the general benefit and the country's good, if the Admiralty were to encourage the engineers in the Navy to make a closer study of heavy electrical power engineering, and especially the polyphase alternating current system; at present the naval engineer has nothing to encourage him in this direction, with a result that they are sent to sea with standard and existing methods of power production and utilization, and when anything in the way of a new thing pops up, they are asked to give their views on same. Well, sir, how can such engineers really give their views on such, when they have no opportunity of utilizing their great practical sea-going experience to the advance of naval engineering? The whole progress in naval engineering is consequently left to private speculation, which some time falls into the hands of unscrupulous financial operators and wire-pullers, with the result that the country has to pay through the nose for its very slow progress, as compared with the advance that other countries have made and are about to make in this direction.

Since Mr. Parsons made his statement, at the discussion on my paper at the Institution of Naval Architects on March 17th, that, in the event of a short-circuit taking place in the engine-room of a large vessel driven by electricity, "everyone in the engine-room would be killed." I have had reasons to make some enquiries as to the possibility of such a deadly work being even probable. I am informed by some of the most learned and experienced engineers in this country and in Germany (where they have much more experience in heavy electrical power engineering than we have over here), that such a statement must be taken with a certain grain of salt. It is a statement all the more amusing, when, on March 15th, Mr. Parsons' application for a patent for electrically-driven ships was accepted by the British Patent Office, and his patent application number 6177 of 1909 is now published, in which he claims the use of high-speed turbines, in conjunction with three-phase alternating current transmission for driving slow-speed propellers for ship propulsion. If your readers will also look up Patent Number 17,248, 1905, they will see that the idea was foreseen and has since been improved on in the "Paragon" system, in which the prime-mover or turbine, as may be, can always run at constant speed, independent of the speed or direction in which the vessel may be travelling, the full control being from the bridge or any suitable position to facilitate quick handling.

Much has been made of Mr. Parsons' remarks in the matter of opposition to electrical driving. I should like to know what would take place in a steam turbine-driven ship if, accidentally, a great bunch of water was suddenly let into the engine-room on the great surface that is represented by the direct-coupled slow-running turbines. I am of opinion that such would be in the order of condensers, and that the blades would suffer by the presence of water, and out they would come.

Your correspondent is not quite right in his statement that naval engineers do not want electrical driving; what they want, and they do not mince their words about it either, is more practical experience in electrical, as well as in strictly mechanical engineering. When such engineers see generators of enormous power driving motors of like power, without the presence of the complicated commutators and brush-gear that is to be seen on all our war-ships, and which is usually attended by a great amount of attention from those hard-worked engineers at sea, they soon change their opinions.

In the matter of auxiliary machine driving the "Paragon" system is very suitable, as by means of the variable frequency that may be obtained, speed variation with efficiency is to be secured, together with reliable working, which is more than can be said for the present system of continuous current that is used on certain ships, and which is giving such fine excuses for the adoption of other means than electrical of driving auxiliary machinery on sea-going vessels of all kinds. If your readers really want some enlightenment on this subject they cannot do better than secure a copy of the Institute of Marine Engineers' Proceedings for last January, in which they will perhaps read with some pleasure the most excellent paper by Mr. John McLaren before the Institute on electrically-driven auxiliary machinery.

I might add that next month a leading consulting naval architect in New York, U.S.A., is sending his electrical engineer to see me with a view of settling the details of running the "Paragon" system on American ships, and so it may come about that America will, after all, set the pace in the adoption of this twentieth-century invasion of the orthodox methods of steam propulsion on the direct propeller drive.

Yours faithfully, WILLIAM P. DURTNALL,
M.I.Mar.E., M.I.Auto.E., Consulting Engineer.

REVIEWS.

The Naval Annual, 1910. Edited by the Hon. T. A. Brassey. J. Griffin & Co., London and Portsmouth. 12s. 6d. nett.

THE Naval Annual has now attained its twenty-fourth year of publication, and the new issue for 1910 quite maintains the high standard set by its predecessors. Compared with the 1909 volume, its contents are of greater interest and variety, and it may be noted that Part I., which is as usual devoted to a review of British and Foreign progress during the past year, a discussion of comparative strength and articles on special topics of national interest, contains about forty pages more of letterpress than did the last edition. Mr. Brassey contributes the first chapter on the British Navy, but owing to his absence in South Africa during the winter, the chapter on Foreign Navies has been undertaken by Mr. John Leyland, who has included in his article a valuable and detailed review of the important circumstances which have brought about such a change in the state of the French Navy, and which bid fair to rescue it from the position to which mismanagement and faulty administration had caused it to fall. Of the special articles, which always form the most attractive feature of the Annual, Admiral Sir Cyprian Bridge writes on "Navy War Councils and General Staffs," Vice-Admiral Sir S. Eardley-Wilmot on "Types of Warships and their Origin." Mr. John Leyland on "The German Navy," and also on "The Command of the Adriatic," Commander C. N. Robinson on the "Resources of the Colonies for Naval Shipbuilding and Equipment," and Captain Alan Field, the superintendent of the Lancashire and National Sea Training Homes, has a paper on his special subject of "Sea Training." Of special interest to our readers will be the chapter on marine engineering, which, as in the last two issues of the Annual, is from the pen of Mr. Alex. Richardson. Mr. Richardson has brought out many valuable points in his article, which he entitles "The Efficiency of the Factors contributing to Speed in Ships." Of special interest is his remark upon the present position of the internal combustion engine for naval purposes:—Experience with small powers is increasing and good results are being achieved, even with reversing engines, but we seem still a long way from the supersession of steam as the prime motive power for large ships. In Part II. there are the tables of British and Foreign ships, compiled by Commander Robinson and Mr. Leyland, and also the illustrative plans of ships by Mr. S. W. Barnaby. The first-named is also again responsible for the section dealing with armour and ordnance progress which forms Part III., while Part IV. is given over to the First Lord's memorandum and other official documents and financial statements. There is appropriately reprinted in this last section an address delivered in Cape Town on December 22, 1909, by Lord Brassey, the Annual's distinguished founder and first editor, whose name would otherwise have been missing from the new volume.

Hydrographic Surveying, Elementary, for Beginners; Seamen and Others. By Commander S. V. S. C. Messum, R.N. (retired). Charles Griffin & Co., Exeter Street, W.C.

THE title of this book sufficiently explains its scope and purpose. Messrs. Griffin were well advised to include a volume on nautical surveying in their scientific text-book series, and no one better able to undertake the writing of such a book could have been found than Commander Messum, of the Royal Naval College at Greenwich. The author is careful to emphasize at the very beginning the principle that surveying, like navigation or any other profession or trade, cannot be learnt by book only. Nevertheless a volume like this one should prove a helpful guide to all those engaged in determining and reporting to the proper authorities the changes that occur in the harbours, rivers, etc., over which they have control. It is well illustrated with charts and diagrams and contains a full index.

Mechanical Drawing. John E. Jagger, M.Sc. (Vic), Whit. Sch. Price 10s. 6d. nett. London: Charles Griffin and Co., Ltd.

THE above is an elementary text book for students in mechanical drawing and provides notes, observations and examples which, if followed through in the manner set out, will give a student the ability to read or to make a simple drawing so that any ordinary workman can understand what is required. The book is primarily intended for those students who are engaged in engineering work, but who have not passed through the drawing office, to enable them to take greater interest in the work passing through their hands by becoming familiar with the drawing office processes and methods. For those students actually engaged in drawing office work, there are many points particularly specified which will be of advantage to them. With regard to the contents a preliminary chapter is given to the tools that such a student must acquire, good advice being given to the students that they need not proceed to buy a box of tools, but must individually select just such appliances of the best make as will be required, whilst they can proceed to buy others when they have become reliable draughtsmen. The author deals with the smallest details, such as an oil thrower for motors or a spanner or screw key, and the beginner's attention is taken up by making intersecting curves or lines and meeting curves, so that the finished product may be clear and sharp. The subject of tracing is dealt with, with examples, the outlines being given clearly and of sufficient thickness, which we consider an advantage, as in the case of students in mechanical drawing their work is too light and thin in the lines for practice. A method of producing, with an example, what is termed sun-prints either in white lines on blue paper or in black lines on a white print is very clearly set out. Then the principle of projection is very well described with isometric projection, and all colours to show the various metals, including lead, timber and stone, are given, to enable the student to use such colours and to determine what materials are indicated by the colours in drawings to which his attention may be given. The volume contains much useful information and the whole scope of the work is most instructive to any student.

The Theory of the Steam Turbine. By Alexander Jude. Price, 18/- nett. London: Charles Griffin & Co., Ltd.

WHEN the first edition of this book was published in 1906 the author stated that his object was to present well-known fundamental principles in a concise and connective way so as to enable direct application of such principles to be made with the steam turbine problem. During the four years that have elapsed between the publication of the first edition and that of the second edition, which is now under review, much experimental and practical work has been effected and some considerable advance has been made in defining the theory upon which steam turbines work. In the new edition the general scheme of the first edition has been retained. The principal problems have been elaborated to a certain extent with a serious endeavour to keep the general mathematical treatment of the subject within fairly simple limits.

The author acknowledges the assistance that has been given to him in dealing with his subject from the theories and solutions of the problem which have been published from time to time in the Technical Press with regard to re-action turbines. He is of opinion that the careful study of the various solutions put forward and the assumptions derived therefrom suggests that fundamental simplifications are wanted, and while mechanical restrictions are unavoidable and formidable it is at the same time difficult to avoid very arbitrary assumptions. Accounts of experiments made to indicate the nature of some of the restrictions are given. The fact must be recognised that precisely similar sections of blading of different sizes have yet to be made, thus constituting a momentary difficulty, leading one to the conclusion that extremely involved calculations, which end in an inevitable compromise, are innumerable.

To those who desire to make themselves more fully conversant with steam turbine practice and to those who desire to take up the subject from the initial stages, the book will be exceedingly useful, not only on account of the arrangement of the matter, but also in view of the large number of diagrams with which the book is so copiously illustrated.

Reed's Drawings of Marine Turbine Engines. Price in case, 3s. 6d. nett; by post, 3s. 9d.

AN extremely interesting set of drawings of marine turbine engines is being published by Messrs. Thomas Reed & Co., Ltd., of Sunderland. Not only are the drawings largely diagrammatical and in this way educational, but they are accompanied by a printed index designating all the parts in the drawings to which reference letters are applied. The drawings comprise two sheets 24 in by 19 in., and not only contain views which enable the action of the turbine to be easily understood, but the pipe arrangements and fittings are separately illustrated, thus affording useful information as to the functions of the parts and their effect on the main portions of the machines.

Board of Trade Arithmetic for First and Second-Class Engineers. By Peter Youngson. Price 5s. nett. Tradeston, Glasgow: James Munro & Co., Publishers.

THIS book contains a series of questions and answers setting forth the types of arithmetical problems put before candidates who sit for examination with a view to obtain Board of Trade certificates. The first questions are so simple that one is led to think them unnecessary in these days of universal school boards, another thought follows that if a candidate fails in arithmetic, and we have heard of a few such, then he deserves to fail, it is entirely his own fault, as the means of acquiring proficiency in working out the questions given as samples in this book have been multiplied during the last thirty years. Probably it is found necessary to set simple questions to begin with and allow the candidate the opportunity of gaining confidence as he goes towards the more difficult problems. The book before us places the questions and answers very clearly before the would-be candidate, and explains briefly the problems and their solutions, so that those who may have learnt at school and grown rusty in arithmetic can here find a beacon to lighten their pathway towards the examination table.

CATALOGUES.

The Rivet, Bolt and Nut Co., Ltd., Glasgow, have sent us a copy of a well got up catalogue of their manufactures. In addition to prices and illustrations it contains approximate weights of bolts, nuts, rivets and bars, particulars of British standard and other tests, hints on heating rivets, standard dimensions and other information, which makes it a handy book of reference.

Consett Iron Co., Ltd. Particulars and sizes of sectional steel supplied by them.

Messrs. John Dugdill & Co., Failsworth, Manchester, describing and illustrating their wide range of electrical fittings.

BOOKS RECEIVED.

The Dollar Magazine for June, 1910.

Steamships and their Story. By E. Keble Chatterton. Price 21s. nett. London: Messrs. Cassell & Co., Ltd.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

New Torpedo-Boat Destroyers.—As recorded in last month's notes, four out of the six special torpedo-boats, ordered recently from shipbuilders throughout the country by the British Admiralty, were secured by Clyde builders—two by Messrs. Yarrow & Co., Scotstoun, and two by Messrs. Wm. Denny & Bros., Dumbarton; the engines for the latter of which will be supplied by Messrs. Parsons' Marine Steam Turbine Co., Wallsend, who are the actual contractors for the finished vessels. Of the fourteen additional vessels of the same standard class since given out, six of these are to be built by Messrs. John Brown & Co., Clydebank, two by Messrs. Wm. Denny & Bros., Dumbarton, and one by Messrs. Wm. Beardmore & Co., Ltd., Dalmuir. Ten vessels have thus been secured by Clyde builders, being one-half of the number so far placed of the twenty-three vessels provided for in the Navy Estimates for the current year. The propulsion of the six special boats will be by twin-screws, driven, in the case of Messrs. Yarrow's two, by Brown-Curtis turbines; in the case of Messrs. Parsons' Co.'s two by geared turbines of the Parson's type; and in the case of Messrs. Thornycroft's two by another arrangement of Parson's turbines. If, as is likely, the three vessels of the standard type which are to be built by Messrs. John Brown & Co. at Clydebank, are fitted with Brown-Curtis turbines, as many as nine of the twenty vessels will be driven by twin-screws.

The London and Glasgow Shipbuilding and Engineering Company, Govan, have now got to the end of the speed and other trials of the torpedo-boat destroyer *Rattlesnake* for the British Admiralty. The Admiralty requirements have been exceeded in every respect, and the vessel gave entire satisfaction to the officials. All the preliminary and official tests proved thoroughly successful on the first trials.

Messrs. William Simons & Co., Ltd., Renfrew, whose wood-working shops have undergone re-building and re-equipment since the recent fire, are being steadily requisitioned by harbour and river authorities at home and abroad for the supply of dredging plant of varied character, all branches of this class of production being long-standing specialities of the well-known Renfrew firm. One of the latest orders received is for the construction of a powerful twin-screw 2,000 ton "Simons" Cutter Hopper Dredger, which will be employed chiefly in reclamation work in the Bay of Durban. The new vessel will be the fourteenth vessel of the dredging class built by the renowned Renfrew firm for the Natal Government, for work at Durban, East London, or other of the Natal seaports.

Messrs. Lobnitz & Co., Ltd., Renfrew, have received an order for a self-propelling bucket dredger and two Hopper barges for the Leopoldina Railway Company, Limited—Messrs. Livesey, Sons, and Henderson, engineers.

Messrs. Babcock & Wilcox, Ltd., Renfrew, have given a repeat order to Messrs. Henry Pels & Co., specialists in punching and sheaving machines, Portsmouth Street, Lincoln's Inn Fields, London, for one of their John's Patent Angle and Tee-Bevel Croppers. In addition to the above, Messrs. Pels are supplying to Messrs. Fleming Bros., girder merchants, Glasgow, one of their John's Patent Joist Shears, also a Combined Punching, Sheaving, and Cropping Machine to Messrs. Redpath, Brown & Co., Ltd., for their Glasgow stock-yard. In addition, a similar tool, but worked by hand-lever, is about to be dispatched to the yard of the famous yacht-building firm, Messrs. Fife & Son, Fairlie.

Messrs. Wm. Beardmore & Co., Parkhead Forge and Steel Works, and Dalmuir Shipbuilding Works, have now entered upon a state of brisk prosperity after the period of dullness which they, in common with other leading Clyde shipbuilding and steel manufacturing firms, too long suffered from. In almost every department Messrs. Beardmore have recently been successful in booking orders. At present they are amongst the builders with the largest warship tonnage on hand, having a new battleship, *Conqueror*, and a Bristol cruiser on the stocks. They have besides in their forge and steel works secured good orders for material for other warships building at other centres. This will be improved by the later orders that have come in for guns. Their gun factory at Parkhead is of recent creation, and gratification is felt at the fact that the firm has already in its initial orders given such satisfaction as to lead to increased contracts. With the likelihood of a continuance in the boom in warship building for years to come, the enterprise of the Glasgow firm in placing their shipbuilding, armour-plate making, forge and gun-making establishments on a plane with the great naval constructive works at Elswick and Barrow, is likely to reap a deserved reward.

Messrs. Napier & Miller, Old Kilpatrick, have contracted to build two passenger screw steamers for foreign owners. One of the vessels is to be 175 ft. in length and the other 125 ft. The firm have recently handed over to the Buchanan Steamers, Ltd., Glasgow, the p.s. *Eagle III.* for passenger service on the Clyde. This vessel, which was engined by Messrs. A. and J. Inglis, Pointhouse, is 215 ft. long, 25 ft. beam, and 8 ft. 6 ins. deep, and on the measured mile attained a speed of 16½ knots.

Messrs. Wm. Hamilton & Co., shipbuilders, Port Glasgow, have recently launched for the fleet of Messrs. John Holt and Co., Liverpool, the steamer *Jonathan Holt*, in which a distinguishing and very noteworthy feature is the provision made for the exclusion of mosquitos from the living and other quarters. All the skylights and air apertures have special coverings of closely worked copper gauze. The port-holes have double doors of ordinary glass for use in the temperate zone, and of copper gauze for replacing the glass when the tropical zone is reached. There are similar double doors in the saloons of the vessels and in the sleeping quarters of the men. Last year the firm placed this mosquito-proof equipment on a small steamer specially built for work on the Niger, and it has turned out a great success, reducing considerably the rate of mortality from disease.

Messrs. Russell & Co., Port Glasgow, it is understood are the builders with whom Messrs. Charles Barrie & Sons, of Dundee, have placed the order for a steamer 450 ft. in length and of large carrying capacity, which will be the longest vessel owned at Dundee.

Messrs. Ferguson Bros., Port Glasgow, are worthily represented at the Japan-British Exhibition by small scaled models, having wealth of detail of many of their notable recent productions in the way of powerful bucket and sand pump dredgers and towing steamers. They also exhibit a large number of photographs, two of which illustrate the launch of the new bucket dredger *Heito Maru* for the South Manchurian Railway Co. This vessel is capable of dredging 1,200 tons per hour from a depth of 50 feet, was built and started on her voyage to Dalny in the remarkably short time of five-and-a-half months, and was the latest dredger built for Japan. Other notable items on their interesting stand are models of the *Lord Desborough*, the largest dredger ever built on the Clyde, capable of raising 4,000 tons per hour from a depth of 70 feet. This vessel has raised material at the rate of 7,000 tons per hour; *The Vulcan*, the largest and latest bucket dredger built for the Mersey Docks and Harbour Board for service at Liverpool, which can dredge to a depth of 45 feet in line with her bow, and was specially designed for dredging in docks, etc.; and the Sand-Pump Dredger, *Pioneer*, built for the Government of Victoria, Australia, specially designed for working in shallow waters and capable of dredging while steaming and of carrying 400 tons in her hopper on a draught of 6 ft. 3 ins.

The Greenock and Grangemouth Dockyard Co., have received an order from a London firm to build a vessel for the dead meat trade from the River Plate. The vessel will be built at the Company's Grangemouth yard and will give welcome relief there, where the majority of the workmen have long been idle and many of them have sought work on the Clyde.

The Caledon Shipbuilding and Engineering Co., Dundee, have received an order from the Clyde Shipping Co. for two steamers for their general passenger and cargo trade.

Messrs. Andrews & Cameron, of Kelvin Engineering Works, Kirkintilloch, have been unusually busy during the past twelve months, principally on evaporators, direct contact heaters, patent pump buckets, packing rings and Martin and Andrew's patent double opening balanced slide-valves. The evaporators of this firm are giving exceptionally good results on long sea trips, and this, of course, is the crucial

test of an evaporating plant. The s.s. *John Hardie* made a trip from Bombay to Hull extending over five weeks without requiring the evaporator opened up for cleaning, and even when opened up in Glasgow after that time, there was very little scale found in the coils. The Donaldson Liner *Cassandra* was fitted with the firm's evaporators plant in 1906, and experience with it in the vessel has resulted in the new Donaldson Liner *Saturnia* being fitted with a duplicate plant. Evaporators have also been supplied to the two new Booth Liners recently built, and an order is on hand for the same Company's new t.s.s. *Hildebrand*. Other recent plants supplied, including distillers in most cases, include those for steamers of the Leyland Line, Messrs. Gow, Harrison and Co., Messrs. Chas. Barrie & Son, Amsterdamsche Lloyd, Messrs. J. Hardie & Co., Messrs. Abram, Addie & Cousin, Embrizia Nacional Co., Lisbon, Scandinavian S.S. Co., Messrs. Bell Bros. & McLelland, Messrs. Harvey Bros., London, Messrs. Nisbet & Calder, and Messrs. Glen & Co. There is also on hand at present evaporating and distilling plants for Messrs. Yarrow & Co., for Dutch torpedo-destroyers. Martin and Andrew's Balanced Slide-Valves are giving great satisfaction, and are not only being fitted to the engines of many new steamers, but are replacing troublesome existing valves every week. During the past twelve months they have been supplied to, amongst others, the City Line, Booth Line, Clyde Shipping Co. Messrs. C. Barrie & Son, Messrs. Clark & Service, Messrs. Gow, Harrison & Co., Messrs. McCall and Pollock, Houston Line, Hawson Line, Messrs. C. H. Crichton & Co., Goodwin & Co., Gulf Transport Line, etc., etc.

Awards to Workmen.—Twenty-eight years ago the firm of Messrs. Denny & Co., engineers, Dumbarton, initiated a scheme of awards to workmen who introduced improvements on any machine used in their works. The working out of these awards was left in the hands of a committee, partly appointed by the firm and partly by the workers, and has given the utmost satisfaction. From a return just issued it appears that during the first seven years the scheme was in existence the claims numbered 70 and the awards 26, for which £103 was paid. During the second seven years the claims numbered 69, the awards 40, premiums 2, and the rewards bestowed £185. During the third seven years the claims numbered 78, awards 47, and the sum paid £160, and during the fourth period of seven years the claims were 125, awards 69, encouragement awards 15, premiums 7, and the recognition paid £417 10s. Thus since the inception of the scheme £863 has been given by the firm for acknowledged improvements. The firm also encourages their workmen by giving premiums of £20 for every five awards gained.

Mid-Scotland Ship Canal.—A local executive committee of the West of Scotland Branch of the Mid-Scotland Ship Canal National Association has been formed in Glasgow to act for the first year of the Association. The Duke of Argyle is the president of the committee, which is representative of municipal, commercial, and industrial interests of the West of Scotland. The work of the Glasgow Branch will consist (1) in getting an expression of approval of the schemes from all Corporations and public bodies in the West of Scotland, and communicating it to the Government with a view to securing the necessary Government guarantee; (2) Pressing upon the Development Commissioners the national demand for the canal; and (3) Making financial arrangements to meet necessary expenses. Sir John Jackson, contractor, has offered to construct the canal if the Government will guarantee 3 per cent. interest on the capital. The Admiralty have announced that the Loch Lomond route is the only one which they would countenance.

TYNESIDE AND WEARSIDE.

(From our Own Correspondent.)

Tyneside.

The Tyne and Solway Canal Scheme.—Considerable interest has been aroused in this locality by the bold proposal of Mr. J. Watt Sandemann, made before the North-East Coast Institution of Engineers and Shipbuilders at Newcastle, to construct a large canal between the Tyne and the Solway. Publicity has already been given to this scheme in several engineering journals, so that it is here only necessary to mention that the proposed length would be 65 miles, the bottom width 148 feet, and the depth 36 feet. The cost is estimated at close on £56,000,000, but, having in view the undoubted success of the Manchester Ship Canal and the Kiel Canal, and the fact that the proposed scheme would be of enormous strategic value, there is nothing inherently impracticable in a scheme put forward by such a well-known civil engineer.

The Improvement Work at Blyth.—There has been a rumour current in this area that the North-Eastern Railway Company were contemplating taking over the docks and harbour works at Blyth. This has, however, been officially contradicted, although there is no doubt that the railway company are doing everything possible to co-operate with the Blyth Harbour Commissioners in making provision for the development of the harbour, which is rapidly becoming a prominent port for the Northumbrian coal trade, and a recent visit of inspection has been made for this purpose.

The Tyne as a Naval Repair Base.—Progress is being made with the propaganda work necessary to make the Tyne a Naval Repair Base. The latest phase is that a memorial is to be presented to the First Lord of the Admiralty urging its claims, the Lord Mayor of Newcastle being chosen as the speaker to represent the district, while Mr. T. Bell will speak for the Newcastle Chamber of Commerce. The deputation will be supported by the local members of Parliament, and great hopes are entertained in this area as to its success.

Messrs. Smith's Dry Dock and Engineering Co., Ltd.—I understand that further important developments are in contemplation by this firm, consisting of a new dock to be built on a portion of their premises at North Shields which was, previous to the establishment of their Middlesbrough yards, used for shipbuilding purposes. The dock is to have a length of 570 feet and a width of 80 feet. The work will probably be put in hand at an early date and will add still further to the efficiency of this firm's equipment. During the past month one of the interesting pieces of work has been the repair of the Russian emigrant ship, the *Lituania*, which was considerably damaged by an accident which was fully reported in the daily papers, and which necessitated the transference of her passengers to another vessel. At the annual meeting of the Smith's Dock Trust Co., Ltd., dividends of 5 per cent. on the preference shares and 10 per cent. on the ordinary shares were declared, indicating a satisfactory state of business.

Messrs. W. G. Armstrong, Whitworth & Co., Ltd.—The prospects of this firm seem at the present time to be more than usually bright. In addition to the work already in hand for the British Government, to which I have already made reference in a previous month, it is now definitely stated that a large battleship for the Chilian Government is now on order, this possibly being due to the growing naval strength of Brazil and the Argentine. It is rumoured that there may be possibilities of a still further increase in the strength of the Chilian navy in the near future. Another contract which is now definitely settled is for a battleship for Turkey, this being the first battleship for that country built by Messrs. Armstrong, Whitworth at Elswick, although they have done some work for them at their Italian yard.

Messrs. Hawthorn, Leslie & Co., Ltd.—This firm is also participating in the naval activity of the present moment as it is to build two of the fourteen additional torpedo destroyers ordered by the British Admiralty. As there are still three more to be placed there is a chance of still more of this type of work coming to the Tyne.

Messrs. Swan, Hunter & Wigham Richardson, Ltd.—Both mercantile marine and Admiralty work is engaging the attention of this firm, who have just launched the *Iadorna*, a vessel for the Cork Steamship Co. of Cork, the engines for which were constructed at the Neptune Works of the same firm. The *N[illegible]hilda* built for the Donald Steamship Co. of Bristol and New York has successfully undergone her trials, while the firm has received an order for a torpedo boat destroyer of the same type as the two above mentioned which passed to Messrs. Hawthorn Leslie & Co.

The Parsons Marine Turbine Co., Ltd. Six torpedo boat destroyers of a special class have recently been ordered by the Admiralty and two of these have been placed with the Wallsend firm who have sublet the contract for the hulls to Messrs. Denny Bros., of Dumbarton.

The Tyne Iron Shipbuilding Co., Ltd.—At Willington Quay this firm is busy finishing a steel screw steamer built on the Isherwood system of longitudinal framing to the order of the International Line Steamship Co., Ltd., of Whitby. This is the first vessel of the type built on the Tyne, and is exceptionally well fitted for the rapid handling of cargo.

Wearside.

Although matters are improving upon Wearside, there is still considerable room for further advance, and nothing very notable is available for record.

Messrs. Robert Thompson & Sons, Ltd.—Messrs. Robert Thompson & Sons, of Southwick, are steadily busy, their yards presenting a satisfactory appearance. The *Remembrance* and the *Triton*, mentioned last month, have now passed to sea, but there appears to be good volume of work in hand.

Messrs. J. L. Thompson & Sons.—The North Sands firm have just launched a cargo boat, the *Boyne*, built to the order of Messrs. Glover, of London, and are now finishing the equipment.

Messrs. Doxford & Sons, Ltd.—At Pallion work is in good progress. The *Royal Crown*, a vessel of 8000 tons deadweight, is now being finished after launch, and will on completion be handed over to the Royalist Steam Shipping Co., of London. Among forthcoming work is the building of a single-deck steamer of 7,400 tons deadweight to the order of Messrs. Farrar, Groves & Co., London.

Messrs. John Dickinson & Sons, Ltd.—Marine engine building in Wearside, as represented by the operations of this firm, appears to be in an improving condition. Among recent engines completed is a triple-expansion engine of cylinder diameters 24 in., 40 in. and 66 in. and 45 in. stroke, working at 180 lbs. per square inch stop valve pressure, for the *Leucadia*, and the two boilers for the same equipment, 16 ft. and 10 ft. respectively, were also made by this firm.

Messrs. Richardsons, Westgarth & Co., Ltd.—This firm have also marine engine building work on hand, and they have recently supplied engines with cylinders 25 in., 40 in. and 67 in. by 45 in. stroke, and three large steel boilers carrying 180 lbs. pressure to the *Natal Transport*, built to the order of Messrs. Furness, Withy & Co., Ltd.

THE TEES AND HARTLEPOOLS.

(*From our Own Correspondent.*)

Middlesbrough.

Trade generally keeps quiet in the town.

Messrs. Bolckow, Vaughan & Co. recently have given notice to practically the whole of the men employed at the Black Boy Colliery to terminate their engagements.

Messrs. Walker, Maynard & Co. have had to blow out a furnace at their Redcar Iron Works so as to reduce production, also one at Tees Bridge for repairs.

Messrs. The Middlesbrough Steel Strip and Hoop Iron Co., Ltd., intend putting down a large iron and steel plant at Vancouver Island, near Victoria.

Messrs. Sir Raylton Dixon & Co., Cleveland Dockyard, keep very busy. They are reported to have secured the contract to build two of six high-class cargo steamers being ordered by The Atlantic Steam Navigation Co.

Messrs. W. Harkess & Son are moderately busy, and are reported to have secured the contract for a small cargo steamer.

Messrs. Smith's Dry Dock Co., South Bank, keep busy building and docking steamers almost to their utmost. They are reported to have booked an order from a Bristol Channel Shipowning Company for three small coasting steamers of about 150 ft. long. At Shields they are constructing a very large dry dock on their late building berth so as to compete with Messrs. R. Stephenson's dock at Hebburn, which, I am sorry to say, is to be offered for sale,

Messrs. Richardsons, Westgarth & Co. are reported to have secured the contract to supply the engine and boilers for the two large cargo steamers to be built by Messrs. Sir Raylton Dixon & Co. They are also fairly busy with work in hand both marine and land.

Stockton and Thornaby.

Messrs. Craig, Taylor & Co. are fairly busy. They have just launched the s.s. *Eggesford* for Messrs. Tatem & Co., Cardiff, which has gone to the North-Eastern Marine Engineering Co., Sunderland, for her machinery.

Messrs. R. Ropner & Sons are only moderately busy; nothing new is reported; orders for tramp steamers are very scarce.

Messrs. Richardsons, Duck & Co. are reported to have secured a contract to build a moderate-sized cargo steamer on the Isherwood principle, and are busy with work on hand.

Messrs. Blair & Co. are reported to be moderately busy; besides a fair amount of work on hand, they are reported to have secured three contracts for machinery for steamers to be built locally.

West Hartlepool.

Messrs. Furness, Withy & Co., shipowners, have bought the late Sir Walter Scott's shares and interest in the Wingate Grange Colliery, of which Sir Christopher Furness and Mr. Barwick are the remaining co-proprietors.

Messrs. W. Gray & Co. continue to book orders; hardly a week passes but that a steamer is launched, mostly of large size, for London or foreign owners.

The Central Marine Engine Works of Messrs. W. Gray and Co. are very busy; their quay has been constantly occupied with machinery for steamers lying alongside, every department being very busy.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Harbour Yard, is very busy. A large 7,000 ton steamer will be launched shortly, whilst the other berths are being well occupied, also the dry docking department.

Hartlepool.

Messrs. Richardsons, Westgarth & Co. have secured the contract to supply the engine and boiler for a cargo steamer to be built by Messrs. Irvine's Shipbuilding & Dry Dock Co. for Sir C. Furness, also a contract to supply the machinery for the s.s. *Lincluden*, to be built by Messrs. J. L. Thompson and Son, Sunderland, to the order of Messrs. Sivewright, Bacon & Co., Manchester. They are reported to be in the running for a large twin-screw cargo boat to be built on the Tyne, also to supply the machinery for the Clan Liner to be built by Messrs. Irvine's Shipbuilding and Dry Dock Co. She will be fitted with Messrs. Jas. Howden's Forced Draught System of about 4,000 I.H.P., and they are very busy in their speciality department.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Middleton, are laying down a third and sister steamer for Sir C. Furness, who is reported to have sold them to Messrs. Houlder Bros., Liverpool. They have booked an order from the Clan Line of Messrs. Cayzer, Irvin & Co. of about 450 ft. long for their general cargo trade. The machinery, which will be of large power, will be supplied by Messrs. Richardsons, Westgarth and Co. This order is reported to have come through Sir C. Furness.

THE HUMBER AND DISTRICT.

(*From our Own Correspondent.*)

Over-sea Passenger Traffic.—Hull claims a large share in the passenger-carrying trade between England and foreign countries. The river-side quay is at full pressure, and the Wilson Liner *Eskimo*, an Atlantic liner in miniature, makes weekly voyages to Christiania, sailing every Saturday from River Side Quay, and other steamers run from all parts. Last year there were 1,002,110 inward passengers, and 1,026,377 outward travellers. Most of the voyages are made with the well-appointed steamers of the Wilson Line, of Hull, and the large new steamer of the R.M.S.P. Co., *Avon*, will visit the port during the summer months. The North-Eastern Railway and Lancashire and Yorkshire Railway Companies are doing their utmost for the new quay with their well-appointed steamers, and train connections between London and Hull.

The Port of Hull.—The employment returns issued by the Board of Trade for the past month are satisfactory, so far as Hull is concerned. In the Humber shipbuilding trade, the percentage of trade union members unemployed in May was only 6·9, as against 15·7 per cent. in the corresponding month last year. In the engineering trades, in the Hull and

Lincolnshire district, the returns are more gratifying, the unemployment figures being but 2·6 per cent., as against 7·8 per cent. in May last year. Work on the Docks at the Humber ports is returned from fair to moderate; in view of the enormous increase of shipment of coal, it is curious to read that with coal porters employment was not very brisk. In Hull and Grimsby things are also looking up, the number of seamen shipped at Hull during the month being 1,076, as compared with 942 in May last year, and the improvement seems to be continuous.

Messrs. Earle's Shipbuilding and Engineering Co., Ltd., are keeping fairly busy with general repair work, dry-docking, slip work, etc., but have no new orders for steamers. The launch will take place early in July of the second steamer of an order of two for the London, Brighton and South Coast Railway, and of a new steamer to run on the Hamburg trade; special attention has been given to the carrying of perishable cargoes.

Hull Central Dry Dock and Engineering Works are busy dry-docking, etc. They have just completed extensive repairs on the s.s. *Ralph Creyke*, of the Lancashire & Yorkshire Railway Co., and have also had several steamers in dry-dock and repairing afloat.

Messrs. Amos & Smith, engineers and boilermakers, have secured a few orders for boilers and machinery for Grimsby and Hull owners. The branch at Alexandra Dock is keeping fairly busy.

North-East Coast Engineering Works.—This new firm is going well ahead. They have had the following steamers under repair and dry-docking:—s.s. *Lamington, Melville, Thames, Cromarty, Harald* and *Eddie*. The first two steamers have been docked and put through Lloyd's survey. The *Melville* has been fitted with new tail shaft, overhauled machinery, several plates renewed in bottom and insulation renewed in after-hold. They have finished and despatched to Santa Rosalia, Mexico, four mortar mills, which completes the order. Several orders are in hand for the dry-docking of steamers.

Messrs. Stewart & Craig, engineers and boilermakers, have had the following steamers and sailing vessels under dry-dock and engine repairs. The ship *Brenn*, a new rudder and new up-take and stays in boiler, and other general repairs; the *Boileau*, for general repairs; and the *London City, Randolf Hanson, Eaton Hall, Katie Jane*, and other small craft.

Messrs. Cochrane & Sons, shipbuilders and engineers, Selby, keep fairly busy. They are now finishing off the remaining drifters built by them, and have also several trawlers on the stocks, and on order for Liverpool, Hull and Grimsby owners, in addition to a small coasting steamer and a tug.

Humber Iron Works have been fairly busy during the past month with general docking and repair work, and the slip has been in general use with various steamers undergoing overhaul. Engine and boiler shops are busy with general repairs and opening out for Surveys.

Goole Shipbuilding and Repairing Co., Ltd.—This yard, under the management of Messrs. Craggs, launched a steamer for the coasting trade for E. P. Hutchinson, Esq., of Hull, designed to carry a dead-weight of 500 tons. She is fitted with triple-expansion engines of sufficient power to drive her at a good sea speed; engines are fitted by Hull makers. She is an up-to-date coasting vessel, having cellular double bottom the whole length of the holds, and is fitted with steam-steering gear, etc., and classed 100 A1 at Lloyd's. The Company is also busy with general repair and new work; amongst other repairs being carried out is the lengthening of a local steam trawler.

W. H. Warren, shipbuilder, New Holland, Lincolnshire, is busy building small craft, and during the month has built a steam lighter for Messrs. Blow, of Grimsby, 200 tons dead-weight; a steam motor barge for Messrs. G. F. Birch and Son, Spalding, 52 ft. by 14 ft. 6 in. by 5 ft.; and is completing several other vessels. Four new vessels for river and coasting are on hand.

Messrs. Woodall & Co., engineers and boilermakers, are keeping busy with repair work on several Danish and Norwegian steamers and coasters in Town Docks, and have a great number of enquiries for their patent blocks for foreign and English companies.

Thomas Tate, engineer and boilermaker, has received a number of enquiries and is doing repairs on several steamers in the docks and old harbour, mostly on coasting and river steamers and mill work.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

Messrs. Day, Summers & Co., Ltd., Northam Iron Works.—Last month the I. of W.'s p.s. *Solent Queen* and H.M. tugboat *Vesuvius* were on the slip for overhaul, and the p.s. *Balmoral* completed her outfit for the season, also the same Company's tug *Ajax* had repairs effected to the boilers. The s.y. *Vanduara*, 450 tons, owner J. Mann-Thomson, Esq., and the s.y. *Honor*, 1,020 tons, owner Baron de Forest, are refitting at the buoys. Last month the firm were busy with the s.y. *Albion*, 1,346 tons, owner C. L. H. Loeffler, Esq. A new house was built for the steering gear and general work carried out in the engine-room. The new patent coal elevator which the firm have in hand, completed satisfactory preliminary trials, and the official trials take place early this month. The 450 tons cargo and passenger steamer built for Liebig's Extract of Meat Co. was launched on the 22nd of last month, and the machinery is now being shipped. Good progress has been made with the 100 ton sheers for Aberdeen and last month the foundation bolts were delivered on the site, and the riveting of the legs completed.

Messrs. J. Samuel White & Co., East Cowes, I. of W., have received orders from the British Admiralty for the construction of two ocean-going destroyers for the 1910-11 Naval Programme. These vessels are similar in design to those already in hand for last year's programme, and will be fitted with Parsons turbines and "White Forster" boilers adapted for oil fuel. H.M.S. *Redpole*, one of the ocean-going destroyers of the 1909-10 programme, was launched on the 24th of last month, also H.M.S. *Basilisk*, ocean-going destroyer ran her official trials with very satisfactory results last month.

The Parsons Motor Co., of the Town Quay, have just completed an interesting motor launch for the Commissioners of Police for the Metropolitan District for service on the Thames. The launch has been named *Sir Richard Mayne*, and carried out her speed and reliability trials in Southampton Water last month. She has been built to the requirements of the Board of Trade, Lloyd's Register, and the Thames Conservancy, and is 52 ft. long by 9 ft. 8 in. beam by 3 ft. 6 in. draught. She is fitted with twin 60 H.P. Parsons marine sets using paraffin fuel. The guaranteed speed under contract was 12 statute miles per hour, and on trial the mean speed of the six runs was nearly one mile per hour in excess of the contract speed. Mr. H. A. B. Cole M.I.N.A., was the consulting engineer and naval architect. The hull of the launch was built by Messrs. White Bros., of this port. The launch will take up her duties early this month.

The "Minnehaha." The work of repairing this vessel of the Atlantic Transport Line is being pushed forward with all speed by Messrs. Harland & Wolff, Ltd., and it is anticipated that the repairs will be completed in about three months. Immediately the vessel leaves the dock the contractors' men will commence with the extensive alterations in connection with the widening and lengthening of the dock, which, when completed, will be one of the finest dry docks in the world, and will be easily able to accommodate the *Olympic* and *Titanic*.

The dredging question has advanced another step, and the position is now as follows. The Harbour Board have decided to dredge to a depth of 35 feet the channel from Thorn Knoll below Calshot and the London & South Western Railway Co. have agreed to pay half the cost of this dredging. The Harbour Board have further decided to dredge the channel from Thorn Knoll to Lawley Beacon to a similar depth, the cost of this portion being borne by the Board. Negotiations are in progress for dredging the remaining portion from Lawley Beacon to the Docks and a satisfactory settlement to all parties concerned is shortly expected.

THAMES.

(From our Own Correspondent.)

Shipping Reports.—Probably the most important news of the month in the shipping world is the big deal made by the Royal Mail Steamship Co., which has agreed to purchase the whole of the Pacific Steam Navigation Co.'s share capital at par value, *viz.*, £25 per share. In connection therewith a circular has been issued to the shareholders, which shows the immediate cause to be the Transandine Tunnel bringing Buenos Ayres closely together with Valparaiso and ports on the Chilian coast, forty hours apart. The Pacific Co will declare its adhesion to the proposal by July 1st, and if accepted, the transfer takes place from October 1st. At the recent meeting of the Royal Mail Co. an interim dividend was declared, making 5 per cent. on the Preference and 3 per cent. on the Ordinary shares. To provide for the purchase (£600,000), capital at present unissued will be called up. Second debenture stock will also be issued. By the acquisition the Royal Mail Co. will practically double its fleet at one stroke, and be in a stronger position to withstand competition from without. Among the more important shipping companies, the Union Castle Line at its meeting declared a dividend equal to 6¼ per cent., and contracts for three new vessels have been entered into. Messrs. W. Cory & Son, Ltd., declared a dividend of 10 per cent. for the year, with a balance forward of £20,782, two new steamers having been added to the fleet during the year. The Shell Transport and Trading Co. pay a dividend of 22½ per cent. for last year and carry forward £205,808.

Trinity House.—Consequent on the accession of His Majesty the King, who, as Prince of Wales was Master of Trinity House, the Duke of Connaught has been elected to the position for the ensuing year, the King, however, remaining an Elder Brother of the Corporation. Captain Herbert Acton Blake has been appointed to the position of Deputy-Master in succession to Captain Sir George Rawlinson Vyvyan, K.C.M.G., who retires under the age limit prescribed by the recent Supplemental Charter, which has been granted the Corporation.

Board of Trade Enquiry.—The stranding of the *Minnehaha*, one of the Atlantic Transport Co.'s boats, on the Scilly Isles last April, has been the subject of an enquiry which has ended in casting the blame on the Master of the vessel for being out of his course, with the result that his certificate has been suspended for three months.

Meteorological Office Changes.—By arrangement with the Lords Commissioners of the Treasury, the Royal Society, the National Physical Laboratory, and the Meteorological Office, the administration of Kew Observatory in so far as experimental work in meteorology is concerned will be transferred to the Meteorological Office from July 1st, the Kew Observatory becoming the central office. The Eskdale Muir and Valencia Observatories will be associated with Kew under the direction of the Meteorological Office. The work of testing instruments now carried on at Kew by the National Physical Laboratory will be removed to Teddington as soon as the necessary arrangements can be completed for the transference.

Sea-going Training.—A four-masted barque, now named *Ama Begonakoa*, a steel vessel has been acquired by Messrs. Devitt & Moore for ocean training purposes, in addition to the *Port Jackson* already employed. A private company is being formed to take over these vessels, and it is understood the Union Castle and Shaw Savill Cos. have promised adherence to the scheme. The new vessel will be renamed the *Medway*, and was launched in 1902 at Messrs. Macmillan's yard on the Clyde. She can carry 4,000 d.w., and will therefore be superior in every way to the *Port Jackson* now engaged in the service of training youths in sea-going ships. That institution, the National Refuge for Children with its training ships *Arethusa* and *Chichester*, moored at Greenhithe has had its meeting, and the report of boys sent into the Navy and merchant service for the year 1909 is most satisfactory. Admiral Sir R. F. H. Henderson, who inspected the boys recently, expressed himself as very satisfied in every way with what he saw.

Corporation Sanitary Infection.—A practical demonstration of the work of the Port of London Sanitary Committee of the City Corporation was afforded to visitors by the Chairman, Mr. Williamson, at the Albert and Victoria Docks. The journey down was made in one of the Committee's own launches, and the inspection was conducted by Dr. Williams, the Medical Officer of Health, the food that comes into the port daily being the chief object of interest. Samples of various articles were tested under the chief food inspector. The jurisdiction of the Committee extends from Teddington to the mouth of the Thames, passengers as well as food coming within its cognizance, and costing the Corporation a large sum per annum.

Yacht Racing.—The Royal Thames Yacht Club opened with its annual match from Southend to Harwich. *Shamrock* had undergone alterations during the winter, and *Brynhild* made her re-appearance, the third vessel being the *White Heather*. Although the last-named was two minutes late in starting she crossed the line first. The same Club's race from the Nore to Dover concluded the series, and in this case *Shamrock* took the lead over *White Heather*. These vessels are cutters of the 23 metre rating.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

WORK generally in the Mersey District continues to be very well maintained; much heavy repair work, and a fair amount of new work, continues to find its way to the local yards. With the excellent building and docking facilities of local builders, it is hoped that shipowners will follow the excellent lead given by the Nelson Line, the Isle of Man Steam Packet Co., and others to encourage local enterprise.

Messrs. Cammell, Laird & Co.—Considerable Admiralty work is now on hand, both for the British and foreign Governments. The *Renard*, on the 18th inst., completed her official trials on the Clyde, when her contract speed was exceeded. The *Wolverine*, of the same class, has also now finished her trials, while the *Racoon* is leaving shortly for the same waters. Work on the machinery for H.M.S. *Blonde* is well advanced, the hull being nearly ready for launching at Pembroke. The large Floating Dock is now well in hand, and it is expected that this huge structure will be finished well up to contract time. Orders for two destroyers of the *Acorn* class have been received from the British Admiralty. Fourteen vessels of this type have now been placed as follows:—Six on the Clyde, three on the Tyne, three on the West Coast, and two on the Solent, £621,006 being placed in the Estimates for these craft. The Argentine destroyers are now well advanced, the first being nearly plated; most of the machinery is in the shops and that for the first of the three boats will be awaiting shipment when the vessel is launched. The tug *Hercules*, for the Havana Coal Co., was launched on the 8th June, and it is expected that she will leave on her long voyage after trial shortly. The Wallasey Ferry boats are now ready for launching, and it is hoped will be running towards the end of July. The *Cæsarea*, the first of the L. & S.W. Rly. boats, was successfully launched on the 4th June, and, with her sister ship, is now nearing completion. The immense works at Tranmere are continually being extended and must be considered amongst the finest and most complete in the country. The firm have still a large volume of repair work passing through the various departments. The coal elevator *Salisbury* has been in for overhaul. The steamer *Uniform* has been sold by London owners to Norwegians for £12,800 and renamed the *Gunhilde*. She is at present undergoing overhaul. The Great Western Railway Co.'s passenger tender *Sir Walter Raleigh* is undergoing repairs. The Midland Railway Co.'s steamer *Duchess of Devonshire* has now completed extensive repairs, including new boilers, and will leave shortly. The Manx steamer *Mona's Isle* and the French ship *Eugene Schneider* have also been in for repairs. It is understood that coke ovens, brick works and plant for dealing with bye-products are being erected by the Company at the Clyde Valley Collieries.

Messrs. H. & C. Grayson.—A large number of repair contracts have been carried out by the firm for local and other

owners, and the several yards have been kept well employed. The *Count Muravjef*, recently fitted up for carrying cold produce, was pronounced to be one of the best equipped vessels for this purpose. The steamers *Adavoca*, *Star of New Zealand*, *Dundalk*, *Napoleon* and *Sunflower* have been in for general repairs. The *Batavega* and *Georgian*, besides others, have had extensive repairs. The two small tenders for the Canadian Pacific Co. are well advanced, while the keels of two steamers building by the firm are now laid.

Messrs. Clover, Clayton & Co.—Many general overhaul and survey contracts have been in hand recently, and the firm's capacities have been fully employed. The steamer *Steindale*, of Bristol, the *Virago* and *Stanley Force* have been in for repairs and overhaul. Extensive grounding damage has been repaired on the *Clarence*, of Swansea, and the *Blackrock*. The steamer *Wisbech* is having damage to bows repaired. At the West Float the Brocklebank steamer *Manipur* is being repaired. In Liverpool the steamer *Gracia* is having new decks put in. An extensive repair contract has been secured by this firm in open competition. One of the large Dover hoppers is now in hand and is expected to remain some time.

The late Sir Alfred Jones.—At a meeting of the committee held in Liverpool on the 8th June, the Lord Mayor presiding, it was unanimously decided to erect a statue to the late Sir Alfred Jones at the Pierhead, subject to the consent of the Corporation.

The Berndorf Metal Works.—A contract of special interest is being carried out by this Liverpool firm for the supply of the galley outfits for the White Star mammoth liners *Olympic* and *Titanic*, the special feature being that these utensils are seamless and are made out of a single piece of pure solid nickel, thus ensuring perfect reliability and efficiency.

A Liverpool Invention.—A wonderful invention has recently been shown at Olympia by Mr. Raymond Phillips, of Liverpool. It consists of an airship completely controlled by wireless telegraphy. The vessel can be made to go ahead or astern, to manœuvre, and a hopper can be made to release bombs at any desired time or place. The machine is all British, and has been under consideration by the British and Foreign War Offices.

Cunard Company.—While this company have recently placed an order for a sister ship to the *Franconia* on the Tyne, there are rumours that still another boat may be ordered. While in size this boat may exceed the *Olympic* the speed will not be in excess of the *Lusitania* and *Mauretania*, whose speed will not likely be exceeded for some years on the Atlantic.

Allan Line.—Tenders were recently asked for by this Company for an express liner. Her tonnage will be about 22,000, with a sea speed of 22 knots, a speed of 23 knots being maintained with ordinary conditions of trim on a 600-mile run. Accommodation for 300 first, 500 second, and 1,500 third-class passengers will be provided, while the tenderers have the option of proposing either quadruple-expansion engines, or the combined arrangement as in the White Star boats. The all-turbine arrangement as in the *Victorian* and *Virginian* will likely be adopted. Following upon the inauguration of the Royal Line, the Canadian services will be vastly improved.

Manchester Ship Canal.—The vast amount of traffic passing though this waterway was emphasised recently by the sinking of the steamer *British Empire* near the Liverpool entrance. This seems to be one of the causes of stoppage that cannot be guarded against, but it seems likely that there may be claims made for demurrage.

BELFAST.

(From our Own Correspondent.)

State of Trade.—Belfast shipbuilders have every reason to be satisfied, at the present time all departments are busy, and as soon as a vessel is launched a fresh keel is laid on the vacated slip. Orders for vessels of big tonnage have recently come this way, and there is every prospect of a brisk spell that will last for some considerable time to come. Repair work has been slack of late, but two or three big jobs have just come to the port, and more than one steamer requiring extensive overhaul and repairs is due here within the next few weeks.

Messrs. Harland & Wolff.—The Queen's Island firm have launched a fine twin-screw steamer named *Pakeha*, which has been built by them for the Shaw, Savill & Albion Co. The new vessel, which is 500 ft. long, 63 ft. beam, and has a gross tonnage of about 8000 tons, is intended for the Company's New Zealand service. She has very large cargo carrying capacity, and accommodation is being provided for a number of passengers. Messrs. Harland & Wolff have the Elder Dempster liner *Port Henderson* in hand for extensive repairs and overhaul; also the *Leopoldville*, which is owned by the Compagnie Belge Maritime du Congo (managers, Messrs. Elder, Dempster & Co.), and was built at the Queen's Island in 1908.

Messrs. Workman, Clark & Co.—On 8th June this firm had a successful trial trip of the new Tyser liner *Muritai*, the vessel afterwards proceeding to Barry to bunker, and thence to London to load cargo for Australia. The *Muritai* is 486 ft. long with a gross tonnage of about 7300, and has been designed and constructed for the Company's frozen meat trade. The *Urmston Grange*, built by Messrs. Workman, Clark and Co. in 1894, has arrived in Belfast for repairs.

Messrs. MacColl & Co.—The steamer *Cheslakee*, built by the Dublin Dockyard Co. for the Union Steamship Co. of British Columbia, Ltd., and engined by Messrs. MacColl and Co., had a successful trial over the new measured mile on the County Antrim coast. The guaranteed speed was 11½ knots, and a mean speed of 12.25 knots was obtained on six runs over the mile. The vessel has been built for passenger trade on the coast of British Columbia, and will shortly sail on her voyage to Vancouver.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Stephen Furness.—On May 10th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, launched from their harbour dockyard a steel screw passenger steamer for Messrs. The Tyne-Tees Steam Shipping Co., Ltd., Newcastle-on-Tyne. The *Stephen Furness* is a handsomely modelled vessel and is of very fine lines in order to obtain the maximum speed on a minimum coal consumption. She is 305 ft. long and is classed to British Corporation Society's highest class. The vessel is a departure from her predecessors inasmuch as instead of the long full poop with a well forward and topgallant forecastle, she has a complete shelter deck all fore and aft, not only affording increased internal capacity for the carriage of dry goods, but makes her a more seaworthy and comfortable vessel. The vessel has a deep bar keel as well as large bilge keels along each bilge for a considerable distance amidships. The accommodation provides for about 250 first class and about 120 second-class passengers. The dining saloon is in a large deckhouse on top of the shelter deck at the fore end of the boiler casing and will be very handsome and commodious, extending the full width of the house, and is a special feature of the vessel, as the passengers do not require to go below to dine, as is usual. At the after end is the main staircase leading below, where the first class state rooms, baths and lavatories are arranged. The first-class smoke-room is in a large house at the after end of the engine-room on the same deck level, and a promenade deck is erected overhead and is extended for a distance of about 150 ft. amidships. On this deck is formed a sheltered seat open at the after end. The second-class passenger accommodation will be fitted up in a most comfortable style and is placed under the shelter deck aft, extending from stern to engine-room bulkhead. The entrance and staircase to same is through a large deckhouse on the shelter deck level, embracing also officers' and engineers' cabins with their separate mess-room, etc., and immediately abaft this is the steam steering gear right over the rudder and at its work. The captain's cabin, charthouse and wheelhouse are on the promenade deck amidships over the dining saloon with flying bridge for navigating purposes. The lavatories, spray baths and the sanitary arrangements throughout are of the most up-to-date type, having the latest improvements. Electric light is fitted throughout the vessel, having embarkation clusters also at port and starboard, mastheads, and stern

as well as clusters for each hatch. Docking and engine-room telegraphs will be fitted so that the vessel can be conveniently handled from the navigating bridge by the officers in charge when leaving and coming into port. The lighting and ventilation will be made as perfect as possible, having electric fans in the public rooms and natural ventilation to each of the other compartments. The appliances for handling cargo include five steam cranes, Macfarlane's patent powerful slewing winches and heavy derricks for lifting heavy weights, also steam capstan aft and quick warping steam windlass forward, and the whole of the appliances and gear are of the latest design to ensure the quickest possible despatch. The vessel is fitted with three large hatches, one aft and two forward, the main hatch being 30 ft. long and the corresponding hatch below is 44 ft. long, so that long material can be easily manipulated in and out of the hold. The vessel has an extra deck forward, namely, lower deck, so that cargo can be separated as desired. She is intended to trade between the river Tyne and London, and when completed will also present a very smart appearance, being quite a miniature Atlantic liner. The machinery has been constructed by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, and is of the triple-expansion type having cylinders 26 in., by 42 in. by 72 in., with a stroke of 48 in., steam being supplied by three main boilers of large size at a pressure of 180 lbs. per square inch, and fitted with Howden's system of forced draught and capable of driving the vessel at a high rate of speed. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the bunkers, double bottom, fore and aft peaks, and boiler-room.

Hellespont.—On May 10th, a powerful sea-going paddle tug, building for the British Admiralty by Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull, was launched. The vessel has been constructed under Admiralty survey as a Royal Fleet Auxiliary. The principal dimensions are:—Length, 145 ft.; breadth, extreme over paddle boxes, 53 ft. 4 in.; depth, 15 ft. 11 in. She is divided into eight watertight compartments, and is specially constructed and strengthened to stand the strain of towing. The towing arrangements are so fitted that the tug can tow either ahead of or alongside of the largest battleships or cruisers. A powerful steam capstan is fitted at the after end for working the large hawsers, and a quick-acting steam windlass is placed at the forward end for working the anchors. Combined hand and steam steering gear is fitted amidships on the upper deck, controlled from wheelhouse on navigating bridge. Large fire pumps are fitted on both sides of vessel, worked by steam and hand power, and connected with numerous long lengths of hose pipes, efficiently coupled together to extinguish fires on board other vessels; also large salvage pumps are supplied, capable of pumping out and raising sunken warships. A complete installation of electric light and electric bells is fitted throughout the ship, including special signal lamps attached to a yard on the top-mast. Large electric "Excello" arc lamps are also fitted on the yard-arms to enable work to be carried on throughout the night. A derrick for lifting heavy weights is fitted to the most. The machinery consists of double compound diagonal paddle engines, with disconnecting shaft, so arranged that the paddle wheels can revolve in opposite directions, to enable the vessel to turn in a very limited space. Separate air and circulating pumps are fitted, and the machinery, built throughout to the latest requirements of the British Admiralty, is capable of driving the vessel at a speed of 12 knots per hour. Steam is supplied by two large cylindrical boilers. The principal features of the tug are her great horse-power, special pumping arrangements, and the effective installation of electric light and appliances, making her a vessel of the most powerful and up-to-date type. The vessel was built under Messrs. Earle's 100-ton swinging Titan crane, which allowed the builders to complete the ship, with all the machinery and boilers on board, ready for steam trials before launching.

Manx Prince.—On May 11th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 117 ft. 6 in. by 21 ft. 6 in. by 12 ft. 6 in. moulded. The vessel has been built to the order of W. H. Beeley, Esq., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Supernal.—On May 11th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw drifter, the principal dimensions being 83 ft. by 18 ft. by 9 ft. 6 in. moulded. The vessel has been built to the order of Mr. Thacker, of Lowestoft, and will be fitted with powerful compound surface condensing engines by Messrs. Crabtree & Co., Ltd., Great Yarmouth, and is replete with all the latest improvements for this class of vessel.

Lincluden.—On May 12th, Messrs. Joseph L. Thompson and Sons, Ltd., of the North Sands Shipbuilding Yard, Sunderland, launched this vessel, she having been specially constructed to the order of Messrs. The Lincluden S.S. Co., Ltd. (Messrs. Sivewright, Bacon & Co., managers), of Manchester. The vessel has been constructed to Lloyd's highest class, under their special survey, the upper deck being fully laid and the main deck for about half length, and with a poop, bridge, and topgallant forecastle. The vessel is very finely modelled and is designed to have a large cubical capacity on a very moderate draught of water. A full complement of deck machinery and fittings will be fitted to facilitate the rapid handling of cargoes. The propelling machinery has been constructed by Messrs. John Dickinson & Sons, Ltd., of Sunderland.

Normandy.—On May 12th, Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull, launched from their yard a handsomely modelled single screw steamer built to the order of the London, Brighton and South Coast Railway Co. for their trade between Newhaven and Caen. The principal dimensions are:—Length, 192 ft.; breadth, 29 ft.; depth, 15 ft. The vessel has been constructed of steel to Lloyd's 100 A1 class, for Channel service, and to Board of Trade latest passenger requirements. She is of the single deck type with bridge and topgallant forecastle. Accommodation is provided for passengers under the bridge and a large dining saloon and a ladies' cabin is situated at the forward end. Powerful derricks and winches are fitted for rapidly loading and discharging cargo. Steam and hand steering gear is fitted over rudder head aft and is controlled by a telemotor standard on the flying bridge. An outstanding feature of the vessel's equipment is the refrigerating plant, which is of the most up-to-date type. The main hold is fitted with up as an insulated chamber, and has a capacity of about 6500 cubic feet. An air cooler is provided at the after end with grids and coils, and cold air is circulated through air trunks in the hold by means of an electrically driven fan. The plant is capable of cooling 60 tons of butter at least 5 degrees Fahrenheit, during the voyage of ten hours. The vessel is fitted throughout with a complete electric lighting installation, and is provdided with a powerful searchlight on the forecastle deck for use in passing through canals. The machinery consists of one set of triple-expansion engines, cylinders $15\frac{1}{2}$ in., 25 in., 40 in. dia. by 27 in. stroke. Steam will be supplied at a pressure of 160 lbs. per square inch by two cylindrical boilers. The machinery throughout is of the highest class, and of sufficient power to propel the vessel a a speed of 12 knots per hour.

Ladywood.—On May 24th, Messrs. Osbourne, Graham and Co. launched from their yard at Hylton, Sunderland, the steel screw steamer *Ladywood*, which they have specially constructed for the well-known trade of Messrs. Wm. France, Fenwick & Co., Ltd., of Sunderland and London, and which is the seventh vessel they have built on the self-trimming principle for this firm. She is 300 ft. by 43 ft. by 21 ft. 8 in., and has been constructed to carry 3500 tons on a light draught to Lloyd's highest class. The accommodation is very commodious and handsomely fitted up, and the vessel is very fully equipped with all modern and special appliances for a vessel of this class. After the launch the vessel proceeded direct to the works of the North-Eastern Marine Engineering Co., Ltd., Sunderland, to receive her machinery, which has cylinders $22\frac{1}{2}$ in., 37 in., 61 in. by 42 in., with two large boilers working at a pressure of 180 lbs., which are designed to drive the vessel a speed of $10\frac{1}{2}$ knots loaded at sea. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the bunkers, holds, and boiler-room tank, and their "Bitumastic" covering to tank top in boiler-room.

Bideford.—On May 24th, Messrs. Craig, Taylor & Co., Ltd., launched from their Thornaby Shipbuilding Yard, Thornaby-

on-Tees, a handsomely modelled single deck screw steamer of the following dimensions, *viz.* :—373 ft. by 51 ft. by 23 ft. 5 in. moulded. She is built of steel to the highest class in British Corporation registry, under special survey, and has poop, long bridge and topgallant forecastle; water ballast in double bottom fore and aft, and in peaks. She is equipped with patent steam windlass with quick warping ends, steam steering gear, eight steam winches, and multitubular donkey boiler, shifting boards, pole masts, double derricks, and all the latest improvements for rapid loading and discharging. Her engines have been constructed by the North-Eastern Marine Engineering Co., Ltd., Sunderland, the cylinders being 25 in., 42 in., 68 in. by 45 in., with two large steel boilers working at 170 lbs. pressure. The vessel has been built for the Tatem Steam Navigation Co., Ltd., of Cardiff.

Malaespera.—On May 24th, Messrs. Sir Raylton Dixon and Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, another of their patent "Cantilever" framed steamers built to the order of Senor Luis de Ocharan of Bilbao, to meet the special requirements of her owner's iron ore carrying trade. The steamer is being built to Lloyd's highest class with engines amidships, and she will have a deadweight carrying capacity of about 4000 tons on a light draught of water. About 650 tons of water ballast will be carried in cellular double bottom and fore and aft peaks, and in addition the triangular tanks under the deck at each side of the vessel will contain another 650 tons, making the total amount of water ballast about 1300 tons. The vessel will have four large holds absolutely free from all obstructions such as beam pillars, or web frames and perfectly self-trimming owing to the sloping sides of the topside tanks under the deck. Access to these holds will be gained through four very large hatchways, the largest of which are 28 ft. 6 in. wide and 35 ft. long, thus making her an ideal boat for the easy and rapid handling of cargo. Triple-expansion engines having cylinders 22 in., 36 in. and 50 in. by 39 in. stroke supplied with steam by two large single-ended boilers working at 180 lbs. pressure will be fitted by Messrs. Blair & Co., Ltd., of Stockton-on-Tees. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied.

Rotherhill.—On May 24th, Messrs. Richardson, Duck and Co., launched from their yard a steel screw steamer of the following dimensions :—Length overall, 313 ft. 6 in. ; breadth extreme, 42 in. 6 ft. ; depth moulded, 22 ft. 5½ in. This vessel, which has been built to the order of Messrs. W. J. Tillett & Co., of Cardiff, will take Lloyd's 100 A1 class and has been built under special survey. She is of the single-deck type with clear holds, extra large self-trimming hatchways, and is also arranged to meet the Admiralty requirements for fleet colliers. A cellular double bottom and peak tanks are fitted for water ballast, and equipment includes eight large steam winches of special type, eight 10-ton derricks, masts being fitted with derrick tables and crosstrees, auxiliary boiler 180 lbs. pressure, steam windlass with quick-warping ends, steam steering gear stockless anchors, etc., etc. The winches and windlass are arranged to exhaust through copper exhaust pipes into a winch condenser, which is fitted with an independent circulating pump. The engines by Messrs. Blair & Co., Ltd., have cylinders 22½ in., 37 in. and 61 in. by 42 in. stroke, steam being supplied by two extra large single ended boilers having a working pressure of 180 lbs.

Sir Francis.—On May 25th, there was launched from the shipbuilding and repairing establishment of Messrs. S. P. Austin & Son, Ltd., the steel screw steamer *Sir Francis*, of 3100 tons deadweight capacity, which has been built to the order of Messrs. Wm. Cory & Son, Ltd., of London. She will be classed 100 A1 in Lloyd's Register, under special survey, large water ballast capacity is provided, and there are large hatchways specially adapted for the owner's coal trade. The machinery will be supplied by Messrs. George Clark, Ltd., of Southwick Engine Works, for fast passages and the auxiliary machinery is by first-class makers. Messrs. Cochran & Co., Annan, Ltd., have fitted a Cochran (Annan) donkey boiler with patent seamless furnace.

Wishful.—On May 25th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw drifter the principal dimensions being 83 ft. by 18 ft. by 9 ft. 6 in. moulded. The vessel has been built to the order of Messrs. The Eastern Drifters Co., Ltd., of Lowestoft, and will be fitted with powerful compound surface condensing engines by Messrs. Crabtree & Co., Ltd., of Great Yarmouth, and is replete with all the latest improvements for this class of vessel.

Indian Prince.—On May 26th, the *Indian Prince*, a finely modelled steel screw steamer built by Messrs. John Readhead and Sons, Ltd., to the order of the Prince Line, Ltd., Newcastle, was launched from the West Dock Shipyard, South Shields. The vessel of the following dimensions—Length, 352 ft. ; breadth, 46 ft. 2½ in. ; depth moulded to shelter deck, 31 ft. 8½ in., is of a superior type, and is being built to Lloyd's highest class, and under their special survey during construction. There is a complete and lofty shelter deck all fore and aft, having wood sheathing over a steel deck. A large steel store-room, strong bullion-room, and insulated ice-room are placed in the 'tween decks under the cabin house. Water ballast is arranged in a double bottom all fore and aft, as well as in large peak tanks at after and fore end of ship, giving a large total capacity. There are six steel water-tight bulkheads. A complete installation of electric lighting throughout the ship has been supplied by Messrs. Clarke, Chapman & Co., of Gateshead. The loading and discharging arrangements are of a very full and complete character. The five large hatchways being served by eleven derricks, eight of which for heavy lifts, are carried on strong out-riggers on the masts, which also are of extra diameter and strength, and one steel derrick with strong special gear for lifting 30 tons is stepped on the deck at both masts. Seven powerful Cyclops steam winches, by Messrs. Clarke, Chapman & Co. are fitted for working the same, and these together with the steam windlass, steam steering gear, etc., are supplied with steam from a large multitubular boiler of marine type, placed in the engine casing. A strong screw steering gear is fitted aft with two hand wheels, and Downton hold pumps are placed on deck and worked from the winches. The engines and boilers have also been constructed by Messrs. John Readhead & Sons, Ltd., the cylinders are 25 in., 42 in., and 69 in. dia. by 45 in. stroke, steam being supplied by two lagre boilers of 180 lbs. pressure, and fitted with Howden's forced draught, and the engines and boilers have been built to the Board of Trade as well as Lloyd's requirements. Special winch condenser, double-cased funnel, independent feed pumps, increased diameter of shafting and other specialities adopted by the Prince Line have also been fitted by the builders. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the bunkers, also in boiler-room.

San Remo.—On May 26th, Messrs. Wood, Skinner & Co., Ltd., successfully launched from their shipbuilding yard at Bill Quay, Newcastle-on-Tyne, a new steel screw steamer which has been built by them to the order of Mr. Otto Thoresen, of Christiania, for his special trades. The vessel is of the single-deck type with large cubic carrying capacity and has poop, extended bridge and topgallant forecastle. She has been built to the requirements and under the special survey of Norske Veritas for the highest classification. An extra quantity of water ballast is provided in the cellular double bottom and after peak tank. The vessel will be rigged as a two masted schooner and will be fitted with eight powerful steam winches, steel derricks and other improvements and appliances for facilitating the rapid loading and discharging of cargo. The machinery has been constructed and will be fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, and consists of a set of powerful triple-expansion engines supplied with steam by two large steel multitubular boilers working at a high pressure and fitted with Howden's forced draught arrangement. The machinery has also been constructed to Norske Veritas highest class. When completed she will be commanded by Captain Jacobsen, of Christiania.

Anglo-Patagonian.—On May 26th, the s.s. *Anglo-Patagonian* was successfully launched from the yard of Messrs. Short Brothers, Ltd., Pallion, Sunderland. The vessel is to the order of the Nitrate Producers Steam Shipping Co., Ltd., of London (Messrs. Lawther, Latta & Co., managers), with leading dimensions :—Length, 420 ft. ; beam, 52 ft. 4 in. ; depth moulded, 29 ft. 1½ in., and is designed to carry a deadweight of about 8500 tons on a moderate draught of water. This vessel, which is of the shelter deck type is the first built on the Wear on the Isherwood system of longitudinal framing, and is also the largest vessel yet constructed in this country on this system, and will take Lloyd's highest class. The double bottom has been fitted throughout for the carriage

of oil fuel or water ballast, and the fore and after peaks are also arranged for water ballast. The holds and 'tween decks are sub-divided by six water-tight bulkheads and by a steel cross bunker bulkhead. The accommodation throughout has been specially designed to give the greatest possible comfort, and a very complete sanitary service is installed. Electric light is arranged throughout the accommodation, in engine-room and tunnel, with large clusters over each hatchway. The cargo arrangements are very complete, sixteen derricks being fitted on tables at masts, and in addition an arrangement of Porter's patent derrick gear to lift 20 tons will be available at each mast, the masts being strengthened to carry this weight. Two derricks to work the cross bunker hatch are placed on strengthened posts, the posts being utilized for the ventilation of stokehold. Ten steam winches, two with extended ends, and the after winch fitted with gipsy wheel, clutch and brake for steam cable, steam windlass, steam steering gear, amidships, controlled by rods to powerful four-armed quadrant on rudder head; Crompton's self-tipping ash hoist, with shoot over side, and fresh water distiller will be supplied, taking steam from a multitubular boiler of 120 lbs. pressure, placed in stokehold, and exhausting to a "Contraflo" winch condenser in discharge recess. Hand-steering gear with two wheels and Lyall's patent rudder brake are also fitted. The vessel will proceed to the North-Eastern Marine Engineering Co., Ltd., Wallsend Works, to have her propelling machinery placed on board; this consists of quadruple engines with cylinders 24 in., 34½ in., 49 in., 71 in. diameter with a stroke of 48 in., driven from three large boilers of 220 lbs. pressure, fitted with Howden's forced draught. The machinery has been designed throughout with a view to economical working, being considerably strengthened above the usual practice, with extra large bearing surface at all working parts. The main condenser is of the "Contraflo" type (Morison's patent).

West Guarter.—On May 26th, the s.s. *West Guarter*, built to the order of Messrs. Jno. Ridley, Son & Tully, of Newcastle, was launched from the yard of Messrs. Wm. Pickersgill & Sons, Ltd., of Sunderland. The principal dimensions of this vessel are:—Length, 254 ft.; breadth, 36 ft. 0 in.; and depth, 18 ft. 10½ in., and she has been built under Lloyd's special survey for their highest class, as a well-decked steamer having deep bulb-angle frames, and water ballast fitted throughout in cellular double bottom and fore and after peak tanks. The vessel has been built as self-trimming collier, with four extra large hatches, and to allow of rapid discharge she is to be equipped with eight winches, and the masts are arranged with eight booms and gafts on each. The machinery, by Messrs. North-Eastern Marine Engineering Co., Ltd., of Sunderland, is to be of the triple-expansion type, having cylinders 20 in., 33 in. and 54 in., with a stroke of 36 in., and an ample margin of steam power for these will be supplied from two large steel boilers with a working pressure of 180 lbs.

Royal Crown.—On May 27th, Messrs. W. Doxford & Sons, Ltd., of Pallion, launched a large single-deck vessel built to the order of the Royalist Steamship Co., Ltd., Newcastle. The vessel is 378 ft. long, 51½ ft. broad, and of 30¼ ft. moulded depth; designed to load 8000 tons deadweight on a moderate draught and steam 11 knots. The classification is with the British Corporation, represented by Mr. J. F. Macdonald and Mr. J. Halbert. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the boiler-room tank and lower bunkers, and their "Bitumastic" covering to tank top under boilers.

Marengo.—On June 1st, the fine steel screw steamer *Marengo* was launched from the yard of The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne. The vessel is 425 ft. in length and 52 ft. beam, with three complete steel decks including the shelter deck all fore and aft, with a cargo carrying capacity of over 8750 tons, and has been built for the fleet of Messrs. Wilson, Sons & Co., Ltd., of Hull. The vessel is constructed in the most up-to-date manner, *viz.*, on the deep bulb angle frame principle with girders under the beams in conjunction with wide spaced built pillars, leaving clear holds, and is fitted with the latest improvements and appliances to make her in every way a first-class Atlantic liner. A large quantity of water ballast is carried in the cellular double bottom and after peak. The shelter 'tween deck is of exceptional height and is arranged so that a large number of emigrants, troops, horses, or cattle can be carried. The loading and discharging facilities are most complete, the steamer having twelve derricks, and ten winches to ensure the most expeditious handling of cargo. An electric light installation will be fitted throughout the vessel. She has been constructed to a fine model with a view to rapid speed and economy in fuel, and the machinery will be supplied by Messrs. Palmers Shipbuilding and Iron Co., Ltd., of Jarrow consisting of engines with cylinders 28 in., 46½ in., 78 in. by 54 in., three boilers 15 ft. 3 in. by 11 ft. 6 in., 200 lbs. pressure, constructed to the requirements of the Hamburg Baupolizei, and fitted with Howden's forced draught.

Eggesford.—On June 6th, Messrs. Craig, Taylor & Co., Ltd., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely modelled single deck screw steamer of the following dimensions, *viz.*:—373 ft. by 51 ft. by 23 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's registry, under special survey, and has poop, long bridge and topgallant forecastle; water ballast in double bottom fore and aft, and in peaks. She is equipped with patent direct steam windlass with quick warping ends, steam steering gear, eight steam winches, and multitubular donkey boiler, shifting boards, pole masts, double derricks, and all the latest improvements for rapid loading and discharging. Her engines have been constructed by the North-Eastern Marine Engineering Co., Ltd., Sunderland, the cylinders being 25 in., 42 in. 68 in. by 45 in., with two large steel boilers working at 170 lbs. pressure.

LAUNCHES—Scotch.

Ord Hill.—There was recently launched at Aberdeen a steam drifter, named *Ord Hill*, which has been built to the order of Messrs. Main Bros., Nairn. The dimensions of the vessel are:—Length, 94 ft.; breadth, 18 ft.; and depth, 10 ft. The vessel will be engined at Aberdeen.

Corncrake.—On May 12th, there was launched at Troon a steel screw awning-decked steamer, which was been built to the order of the General Steam Navigation Co., Ltd., London, for their Continental trade. Her principal dimensions are:—Length, 240 ft.; breadth moulded, 35 ft.; depth moulded, 25 ft. She has a tonnage of about 1,200 gross, and is classed 100 A1 at Lloyd's. The vessel is designed to carry cargoes of iron bars of large longitudinal dimensions.

Damara.—On May 12th, Messrs. Alex. Stephen & Sons, Ltd., Linthouse, launched a large new cargo steamer named *Damara*, for Messrs. Maclay & McIntyre, Glasgow. The *Damara* is a sister ship to the *Romera* and *Masunda* recently built by the Linthouse firm for the same owners. She has been constructed to Lloyd's highest class, and her dimensions are:—Length, 403 ft.; breadth, 52 ft.; depth, 30 ft. She has been designed and fitted out as a first-class deadweight carrier. The machinery, which has also been supplied by the builders, consists of a set of triple-expansion engines, having cylinders 25 in., 41 in. and 67 in. diameter, with a stroke of 51 in., and supplied with steam from three large single-ended boilers fitted with Howden's forced draught.

Crosshill.—On May 12th, Messrs. Archd. McMillan and Son, Ltd., Dumbarton, launched the steel screw steamer *Crosshill*, which they have built to the order of Messrs. Macbeth & Co., Ltd., Glasgow. The vessel is of the following dimensions, *viz.*:—Length, 400 ft.; breadth, 52 ft.; depth, 30 ft.; and is constructed with clear holds. Large water ballast capacity is provided for in cellular double bottom, both peaks and in deep tank amidships. The vessel is designed to carry a deadweight of over 8,300 tons with Lloyd's summer freeboard. The vessel is fitted out in a very complete manner, having an installation of electric light, etc. The machinery is by Messrs. David Rowan & Co., Glasgow, and both vessel and machinery have been built under special survey of Lloyd's for their highest class. The vessel left early in June for her trial trip and afterwards proceeded to Newport to load.

Braes o' Buckie.—On May 21st, a steam drifter, built for Messrs. Cowie, Jappy & Murray, Buckie, was launched at Aberdeen. The vessel is 80 ft. long, 18 ft. broad, and 10 ft. deep. She was named *Braes o' Buckie*.

Highland Corrie.—On May 21st, there was launched on the Clyde the steamer *Highland Corrie*, which has been built for Messrs. Nelson, of Liverpool and London, for the frozen meat trade between London and Buenos Ayres. The vessel is 430 ft. in length, 30 ft. in breadth, 29½ ft. in depth, and of 7400 tons gross. She is a sister ship to the recently-launched *Highland Rover* and *Highland Pride*.

Renvoyle.—On May 29th, there was launched from the works of the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, a steel screw package freight steamer 250 ft. by 42ft. 6 in. by 16 ft. 8in., for service on the Great Lakes Canadian trade. The vessel was named *Renvoyle*, and immediately after the launch was placed in the company's dock to receive her machinery, which has also been constructed by the builders. The vessel has been built under Lloyd's survey.

Anna.—On June 7th, there was launched at Campbeltown a steel screw steamer named *Anna*, which has been built for German owners. The vessel is about 2200 tons deadweight, and is of the single-deck type.

Alert.—On June 8th, there was launched on the Clyde a steamer of 200 tons for the Guernsey Steam Towing and Trading Co., for their passenger traffic among the Channel Islands and to St. Malo. Triple engines of 700 tons i.h.p. are being supplied.

Carnduff.—On June 9th, there was launched a steel screw cargo steamer to carry about 300 tons deadweight, built to the order of Messrs. Howden Brothers, Larne, for their general coasting trade. The vessel has been fitted with all modern appliances for rapid handling of cargo. The machinery, which is placed aft, consists of a set of compound surface-condensing engines supplied with steam from a large boiler working at 130 lbs. pressure.

Jonathan Holt.—There has been recently launched at Port Glasgow a handsomely modelled steel screw passenger and cargo steamer, built to the order of Messrs. John Holt and Co., Ltd., of Liverpool. The principal dimensions are as follows:—Length, 260 ft. 6 in.; beam, 38 ft.; depth to main deck, 18 ft. 3 in.; depth to shelter deck, 26 ft. 0 in. The vessel, which is intended for the West African passenger and cargo trade, is rigged as a fore-and-aft schooner. Special attention has been given to ventilation, electric fans being introduced. Mosquito screens have been fitted throughout. The vessel is provided with a large refrigerating plant, with cooling chambers. The vessel has been built to Lloyd's highest class, special survey.

Duchess of Richmond.—On June 11th, there was launched from the yard of Messrs. David & William Henderson & Co., Ltd., Partick, the handsomely modelled paddle steamer *Duchess of Richmond*, which they have constructed for the London & South-Western and London, Brighton and South Coast Railway Co.'s for their Portsmouth and Isle of Wight traffic. The dimensions of the vessel are 108 ft. by 20 ft. by 9 ft. moulded, and she is fitted throughout in the most up-to-date style, the first-class accommodation aft is of the most complete character whilst the second class have comfortable quarters forward. The vessel will have compound diagonal engines with cylinders 27 in. and 51 in. dia. by 54 in. stroke, and one double-ended multitubular boiler working at a pressure of 130 lbs.

Highland Scot.—On June 11th, there was launched at Port Glasgow the steamer *Highland Scot*, which has been built to the order of Messrs. H. and W. Nelson, Ltd., Liverpool and London. The vessel is a sister ship to the *Highland Corrie*, launched three weeks ago. The dimensions are:—Length, 230 ft.; breadth, 56 ft.; depth, 20 ft. 6 in.; with a gross tonnage of 7400 tons. Specially designed for the carrying of frozen meat between Buenos Ayres and this country, the steamer is insulated throughout. Accommodation is provided for eighty first-class and thirty second class passengers, and the vessel is handsomely equipped, having well-appointed dining and smoking saloons, library and recreation rooms. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the bunkers and boiler-room tank, and their "Bitumastic" covering to tank top in boiler room and decks in refrigerating spaces.

LAUNCH Irish.

Pakeha.—On May 26th, Messrs. Harland & Wolff, Ltd., Belfast, launched the large twin-screw steamer *Pakeha*, which they have built to the order of the Shaw, Savill and Albion Co., Ltd., for their New Zealand trade. The new vessel is nearly 500 ft. long, by 63 ft. beam, with a gross tonnage of about 8000. She will carry a number of passengers, for whom comfortable accommodation will be provided; the vessel will also have a very large cargo capacity, and will be fitted complete with refrigerating machinery and insulated chambers, electric light, and the latest improvements. The propelling machinery, which is also being constructed by the builders, consists of two sets of quadruple-expansion engines, and the vessel is being built under Board of Trade and also the highest class at Lloyds.

BOARD OF TRADE EXAMINATIONS.

1910	Extra First Class.	
May	5th—Adams, J. C.	Ex 1C Glasgow
,,	5th—Alder, J. D.	Ex 1C Liverpool
,,	5th—Boulding, L. H. ..	Ex 1C London
,,	5th—Cochrane, W. M'N ..	Ex 1C Glasgow
,,	5th—Flockhart, T. J.	Ex 1C Liverpool
,,	5th—Hay, L. W. McG ..	Ex 1C N Shields
,,	5th—Innes, W.	Ex 1C London
,,	5th—Koster, F. W.	Ex 1C N Shields
,,	5th—Muers, Percy	Ex 1C London
,,	5th—M'Gregor, R.	Ex 1C Glasgow
,,	5th—Pickles, G. A.	Ex 1C W. Hart'l

NOTE—1C denotes First Class; 2C Second Class.

March 24th, 1910.

Anderson, A. ..	2C	Greenock
Allen, E.	2C	N Shields
Armston, John	1C	N Shields
Brown, J. R. ..	2C	N Shields
Bardsey, H. ..	1C	Liverpool
Blackwood, T.	2C	Aberdeen
Cameron, A. B.	2C	Aberdeen
Cameron, D. ..	1C	Sunderl'd
Coffer, D. G. ..	1C	N Shields
Courtney, J. W.	2C	Liverpool
Clements, C. H.	1C	Liverpool
Davison, J. R.	2C	N Shields
Driver, G.	1C	N Shields
Gow, W. A.	1C	Aberdeen
Gray, J.	1C	Greenock
Grey, D.	2C	London
Griffiths, E. ..	2C	Liverpool
Hajan, J. Z. ..	1C	N Shields
Henricksen, L.	2C	Hull
Inwood, A. W.	1C	London
Jolly, R. A.	1C	Aberdeen
Lyle, D.	1C	London
Mason, F. S. ..	1C	Sunderl'd
Matthew, W. W.	1C	London
Macaulay, W. ..	1C	Greenock
Morris, F. S. ..	2C	Greenock
Ogden, P. E. C.	1C	London
Prophet, D. B.	2C	Liverpool
Prydie, R. C. ..	2C	Greenock
Robinson, S. ..	2C	N Shields
Richardson, J. A.	2C	Liverpool
Ross, A.	2C	Aberdeen
Salmon, E.	1C	N Shields
Skinnin, W. H.	2C	L'nderry
Stark, G.	1C	Liverpool
Stephen, W. A.	1C	Aberdeen
Stuart, G.	1C	Aberdeen
Tawse, A. B. ..	2C	London
Tate, J. R.	2C	Sunderl'd
Torresen, A. G.	2C	London
Thomas, J. W.	1C	Bristol
Tindel, A.	2C	Aberdeen
Watson, F. F.	2C	N Shields
Weenink, H. ..	1C	London
Wilson, D. L. ..	1C	Liverpool
Evans, T. K. ..	1C	Cardiff
Fraser, H.	2C	Glasgow
Gray, C.	2C	Liverpool
Griffin, S. J. ..	2C	Cardiff
Harvey, H. C. J.	2C	London
Henry, W. T.	2C	Glasgow
Hopper, W. T.	2C	London
Jackson, A.	1C	Glasgow
Jones, A. L. ..	2C	Cardiff
Liddell, H.	2C	N Shields
Malcolm, A. ..	2C	South'ton
M'Lean, A.	2C	Liverpool
Nisbet, R.	1C	Liverpool
Nicholson, N. R.	2C	South'ton
Parker, C. W.	1C	N Shields
Prentice, C. S.	1C	Glasgow
Rowson, W. E.	1C	Liverpool
Stark, G. H. ..	1C	London
Stewart, J. R. ..	2C	Leith
Stewart, J. C. ..	2C	Glasgow
Sturrock, G. S.	1C	Leith
Sharp, F. W.	2C	Cardiff
Taylor, P. E. ..	2C	N Shields
Watson, D. D.	2C	Leith
Wilson, John ..	2C	N Shields
Williams, R. ..	2C	Liverpool
Williams, J. G.	1C	Cardiff

March 31st.

Arundel, G. E.	1C	Glasgow
Back, F. C. ..	2C	N Shields
Blair, S. G.	2C	Belfast
Cousins, B. J.	2C	Falmouth
Cran, H. A. S.	2C	Leith
Denby, J. S.	2C	Falmouth
Dowey, James	2C	N Shields
Dockwrey, D.	1C	N Shields
Dryden, J. D.	2C	Liverpool

April 7th.

Blackmore, J. ..	1C	Liverpool
Clark, S. J. ..	1C	Liverpool
Hudge l, A. V.	1C	London
Jack, W.	2C	Liverpool
Kirkwood, P. T.	1C	Liverpool
Mercer, G.	2C	Liverpool
M'Donald, R. B.	2C	Liverpool
Peel, G.	1C	Liverpool
Shennan, J. B.	1C	Liverpool
Tomlinson, C. F.	1C	London

April 14th.

Anderson, A. M.	1C	Greenock
Baird, W.	2C	Greenock
Bell, J.	2C	Liverpool
Black, J. O. ..	2C	Dundee
Brown, W.	2C	Greenock
Callen, F. S. ..	2C	Liverpool
Dutt, W. S.	1C	Greenock
Ferguson, D. ..	1C	Greenock
Garven, W.	2C	Liverpool
Hazel, J. E. C.	2C	Liverpool
Jarvie, J.	2C	Greenock
Johnson, J. G.	1C	N Shields
Lawson, J.	2C	Liverpool
Ledgett, G. D.	1C	N Shields
Macpherson, A.	2C	Greenock
Mackenzie, A.	2C	Dundee
Mavin, Alfred	2C	N Shields

Millar, M R .. 1C N Shields
M'Bryde, T A. 2C London
M'Dougall, A A. 1C Greenock
M'Kinley, R .. 1C Dublin
M'Lardie, J M'A. 1C Greenock
M'Murchy, J C 2C Greenock
M'Lachlan, A 1C Greenock
Page, R B .... 2C Liverpool
Pollard, E V. 2C N Shields
Robertson, I .. 1C Greenock
Spencer, A J... 2C London
Tannahill, D. W 1C Greenock
Whitehead, F. 1C N Shields
Wright, J .... 2C N'Shields

April 21st.

Aitken, R. G .. 1C Glasgow
Atkinson, Wm. 2C W Hart'l
Armour, R .... 2C Glasgow
Baker, C. T D 1C N Shields
Bell, G .... 2C W Hart'l
Benney, A J .. 2C Plymouth
Booker, E E... 2C Cardiff
Bradley, A J .. 2C London
Calvert, F .... 2C W Hart'l
Carswell, J A. 2C Glasgow
Castello, W E. 2C South'ton
Coulter, T .... 1C Leith
Crombie, T E. 1C Leith
Davis, R. W... 2C N Shields
Dawkins, W. A 1C South'ton
Douglas, J. W. 2C Liverpool
Douthwaite, G.S. 2C N.Shields
Grant, G W... 2C London
Haddow, Wm. 1C South'ton
Hadden, R. S. 1C Leith
Holme, D. W. 1C Liverpool
Hugill, H. .... 1C W Hart'l
Isgar, C. H .. 2C South'ton
Jones, T. R. .. 1C Cardiff
Jones, T. L. .. 2C Liverpool
Kerr, W ...... 2C Glasgow
Lochhead, J. M'C 2C Glasgow
Macdonald, A. 2C London
Mackay, R..... 1C Glasgow
Martindale, H. 2C Barrow
Millar, R. .... 1C Leith
M'Grillies, T .. 1C Glasgow
M'Ilgorm, T .. 2C Liverpool
Naydis, H C 2C Leith
Nott, G ...... 2C Cardiff
Penman, J. G. 1C Leith
Peters, R. J .. 2C Cardiff
Peters, T W... 1C Cardiff
Rathbone, W L. 1C Leith
Reed, H ...... 1C South'ton
Reid, J. ...... 1C Liverpool
Robertson, G 2C Liverpool
Rose, John .... 2C Glasgow
Rigg, W. W .. 1C Leith
Schneider, A H 1C Cardiff
Seed, W ...... 2C Liverpool
Service, W. .. 2C Glasgow
Stephens, R. R. 2C Barrow
Stockwood, W 2C Cardiff
Stubbs, N. N... 2C Glasgow
Wilson, J. .... 2C Liverpool

April 28th

Anthony, G F. 2C N Shields
Baker, A H .. 2C N Shields
Banks, J ...... 2C Greenock
Blackwood, J N. 1C Greenock
Boswell, S K 1C Hull
Brown, C W .. 1C Sunderl'd
Bridge, W .... 2C Liverpool
Burdon, S J L 2C N Shields
Caird, W .... 2C Liverpool
Campbell, R F 1C Greenock
Campbell, J .. 1C Greenock
Carr, G P .... 1C Sunderl'd
Charlton, J .. 1C N Shields
Crockett, R A 2C Liverpool
Cudlipp, A. B. 1C Bristol
Dickie, R F. .. 2C London
Dickie, John .. 2C Greenock
Farrell, W. .... 2C Liverpool
Fortune, H .. 1C Sunderl'd
Fountain, L B 1C London
Fullerton, G .. 1C Aberdeen
Gichard, J L 1C Liverpool
Haylett, A A. 1C London
Hunter, J T... 1C Greenock
Leeder, W. C. 2C N Shields
Lister, A ...... 1C Sunderl'd
Mail, J. S. .... 1C Sunderl'd
Macfarlane, G.S. 2C Greenock
M'Lean, R. .. 1C Greenock
M'Culloch, R .. 2C Greenock
M'Lennan, G J 2C Aberdeen
M'Nicoll, W .. 2C Aberdeen
Milne, A. C. .. 1C London
Nash, T J .... 2C Liverpool
Newton, R. B 1C Aberdeen
Ramsay, F. L. 1C Aberdeen
Ramsay, James 1C Greenock
Sankey, R. W 1C Liverpool
Scott, A. P .. 1C Liverpool
Skelton, H .... 1C London
Warren, C .... 1C Sunderl'd
Welcome, E W 1C Hull
Williams, J. H. 1C Liverpool
Yates, G W. :. 2C Liverpool

May 5th.

Anderson, W. A. 2C Glasgow
Andrew, J. H 2C South'ton
Bell, William .. 2C N Shields
Bell, John .... 1C N Shields
Bell, W ...... 2C Leith
Beattie, T. .... 1C Belfast
Boyle, A. H. .. 2C London
Campbell, A. .. 2C Belfast
Convery, B .. 2C Glasgow
Craigen, G C R. 2C Leith
Davey, S. .... 1C Belfast
Dickman, E. .. 1C Glasgow
Doherty, C. G 2C Belfast
Drummond, T. 2C Glasgow
Earnshaw, R .. 2C N Shields
Fearn, M. .... 2C Glasgow
Flory, H G. .. 2C Glasgow
Gander, J S .. 1C London
Gittens, H .... 2C Liverpool
Greggans, F. J 2C Cardiff
Griffiths, H. .. 2C Cardiff
Helyer, R L .. 2C London
Houston, A. T 2C Liverpool
Jack, J ...... 2C Leith
LaFrenais, W H 1C Glasgow
Larbalestier, E. 1C South'ton
Mason, J. F. .. 1C Liverpool
Macfarlane, T. 1C Glasgow
Miles, J H..... 2C Cardiff
Mill, W. E..... 2C Falmouth
M'Goun, M A 2C Glasgow
M'Nab, R .. 2C Glasgow
McRoberts, O J 2C Cardiff
Pearse, F P .. 1C Liverpool
Potts, W S .. 2C Liverpool
Rae, J. .... 2C Liverpool
Rees, John .... 1C Cardiff
Rees, T A ... 2C Cardiff
Roberts, S .... 1C Liverpool
Soulsby, G .... 1C Liverpool
Spedding, M J. 1C Liverpool
Stirling, A W 2C London
Threadgould, P. 2C Liverpool
Thomas, J. E 2C South'ton
Tranfield, C E. 2C London
Turner, L C .. 2C South'ton
Watson, R..... 2C Falmouth
Whittaker, E F 1C Glasgow
Winter, H L 2C Cardiff
Williamson, G 2C Liverpool

The Marine Engineer and Naval Architect Patent Record.

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No. 1390. Governors.—To maintain constant the speed of motors driven by fluid supplied from two sources at different pressures, the load on the governor is automatically varied when a change is made in the source of fluid; in addition, the governor may be influenced by separate means to control the speed variations consequent upon changes in the load on the motor. As applied to a mixed-pressure turbine normally running on a low-pressure supply, the difference of pressure that exists across the whole or part of the high-pressure element is used, when running under high-pressure steam, to vary the load on the governor. As shown in Fig. 2, the Bourdon tube (*a*) is connected to the high-pressure steam-pipe (*b*) and to a link (*d*) which, through adjusting-rods (*m*, *p*, *g*), acts on the governor (*h*). The casing surrounding the Bourdon tube is connected through the pipe (*b1*) to a point on the turbine, either at or before the low-pressure steam inlet. On a change-over from low to high-pressure steam, the Bourdon tube acts to lessen the load on

FIG. 2.

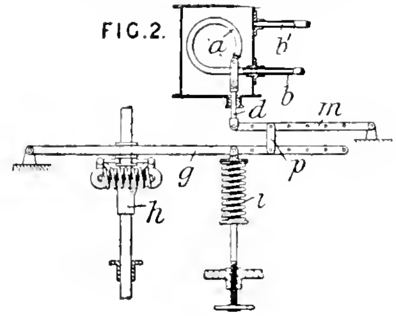
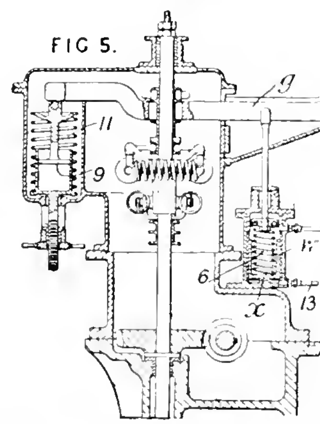


FIG 5.



the governor and maintain the speed constant. A hand-regulated spring (*l*) may be used for adjustments, and the Bourdon tube may be connected directly to the rod (*g*). In a modification, the pressure difference acts on a piston (*x*, Fig. 5), mounted in a cylinder (*w*), the cylinder being connected under the piston by the pipe (13) to the high-pressure element. The piston acts on the governor through a spring (6), which is always slightly in compression, so as to tend to return the piston to its lowest position. On the further end of the rod (*g*) is mounted a dash-pot piston (9), having a surrounding spring (11) adjustable by hand. In a further modification, the piston may overbalance a weight adapted, when high-pressure steam is used, to fall on a lever and lighten the load on the governor. The means used to control the governor under a change in the load may comprise a solenoid arranged to act on the governor, the action thereof being proportional to the changes in the voltage or the current of a dynamo driven by the turbine, etc. Further, the above control devices may be used in conjunction with the devices described in specification No. 6180, A.D. 1908.